

APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Brain; Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.885 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 850, Right Head, Slide In, Touch, Mid.ch

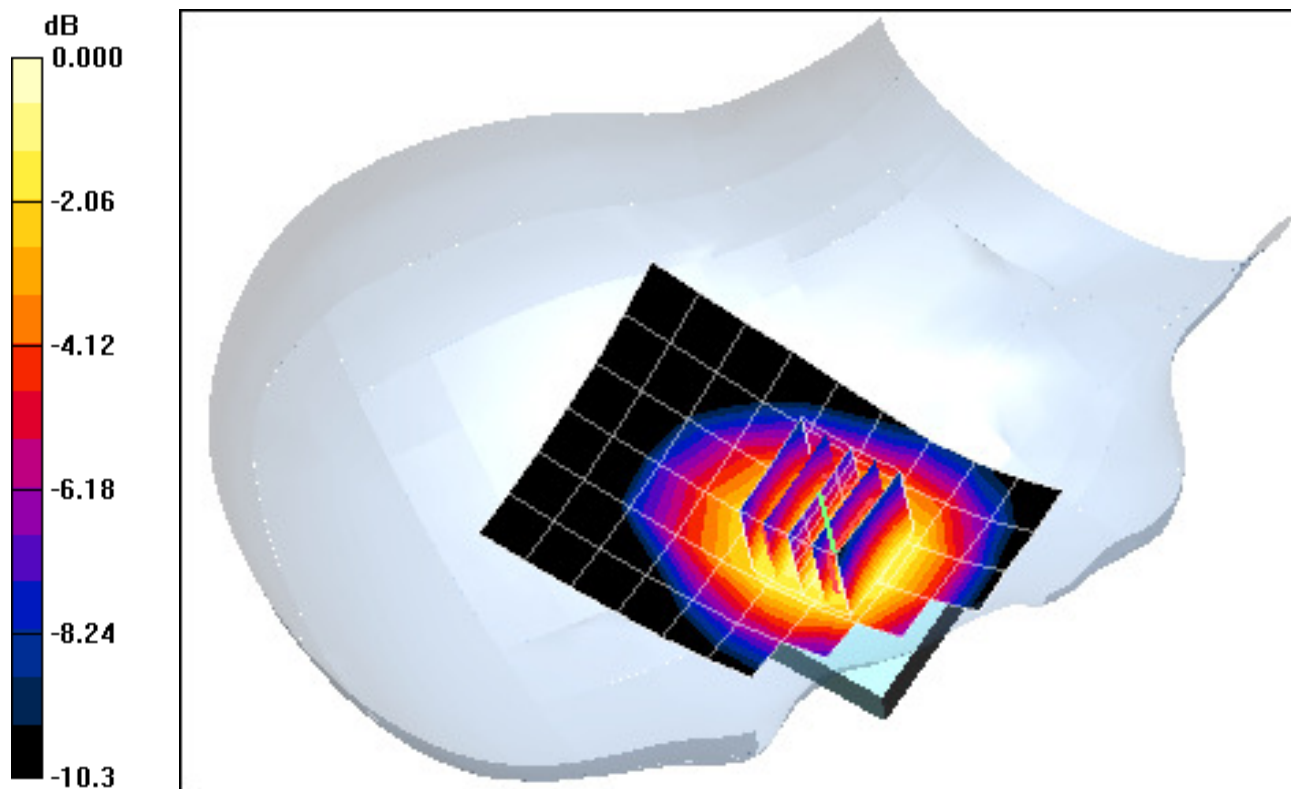
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 4.72 V/m

Peak SAR (extrapolated) = 0.180 W/kg

SAR(1 g) = 0.139 mW/g; SAR(10 g) = 0.101 mW/g



0 dB = 0.155mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Brain; Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.885 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 850, Right Head, Slide In, Tilt, Mid.ch

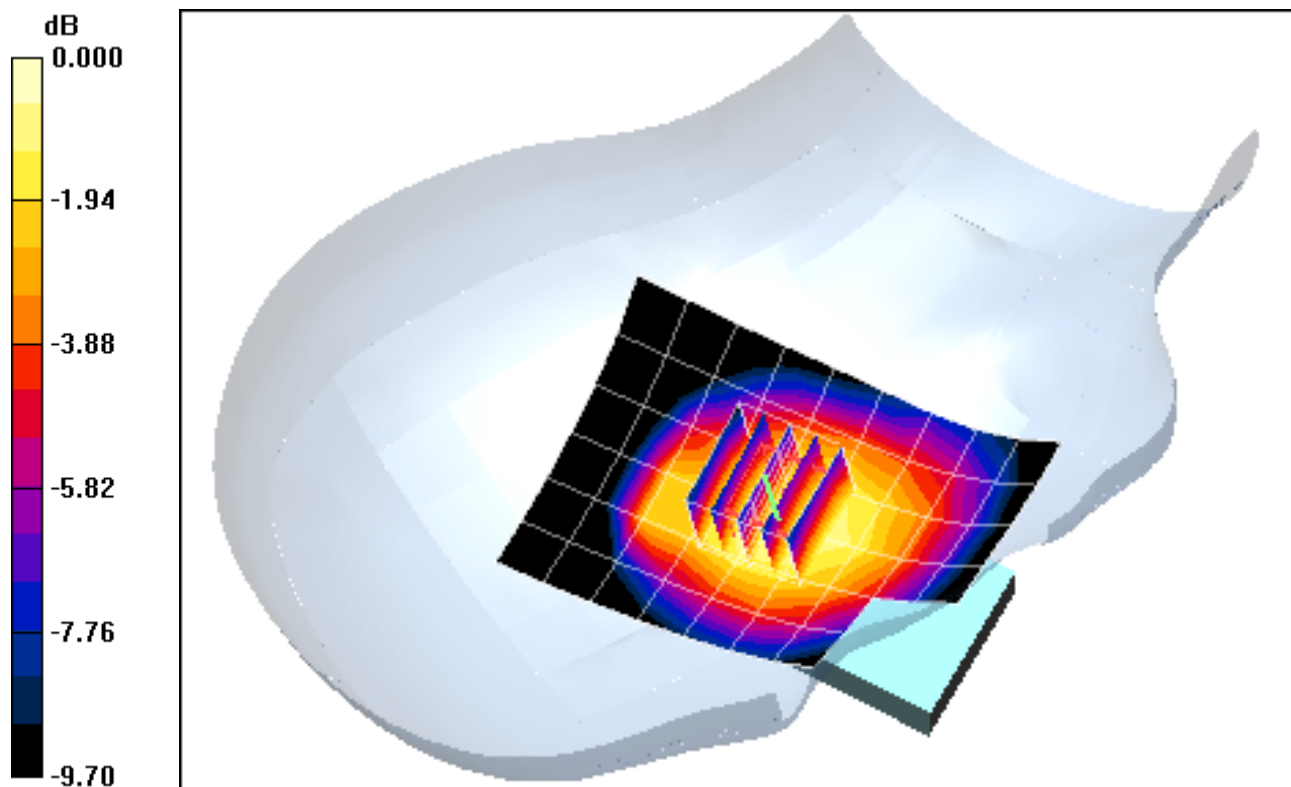
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 7.07 V/m

Peak SAR (extrapolated) = 0.100 W/kg

SAR(1 g) = 0.077 mW/g; SAR(10 g) = 0.056 mW/g



0 dB = 0.086mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Brain; Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.885 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 850, Left Head, Slide In, Touch, Mid.ch

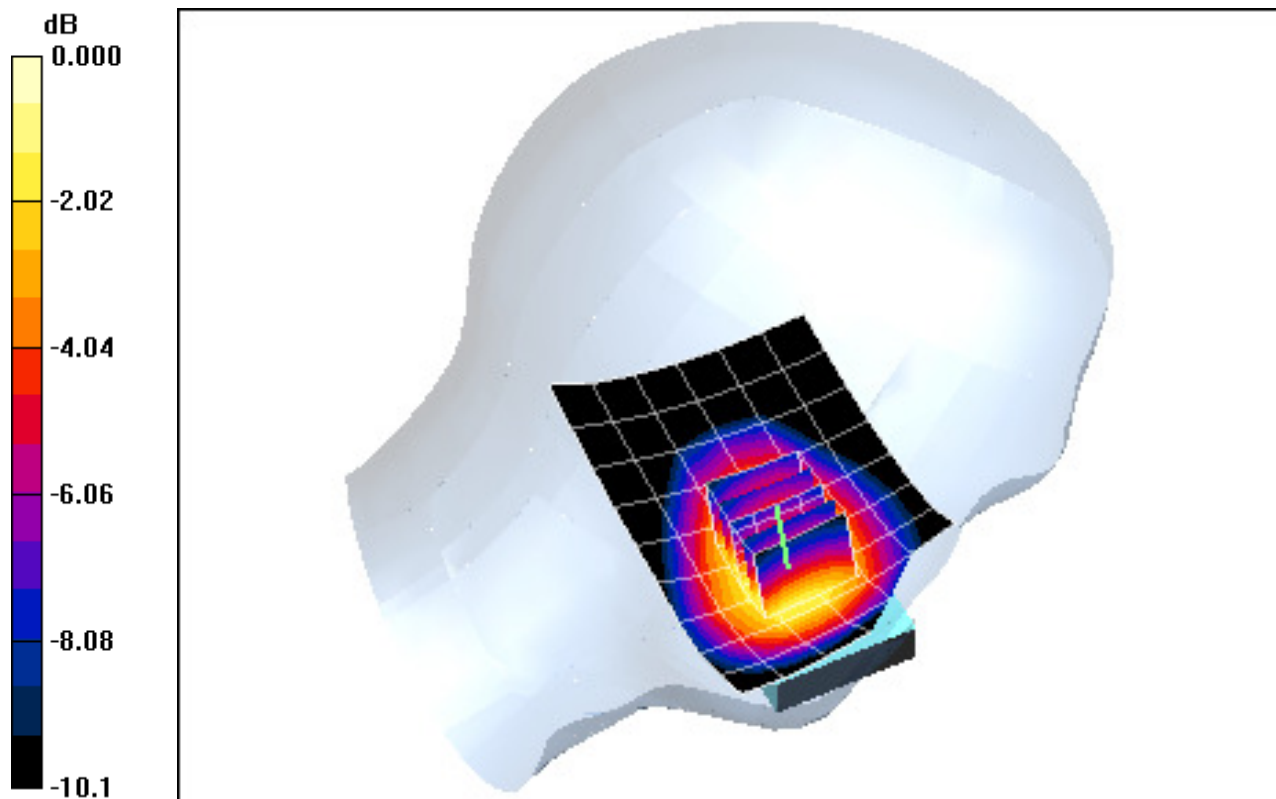
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 6.37 V/m

Peak SAR (extrapolated) = 0.321 W/kg

SAR(1 g) = 0.244 mW/g; SAR(10 g) = 0.175 mW/g



0 dB = 0.275mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Brain; Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.885 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 850, Left Head, Slide In, Tilt, Mid.ch

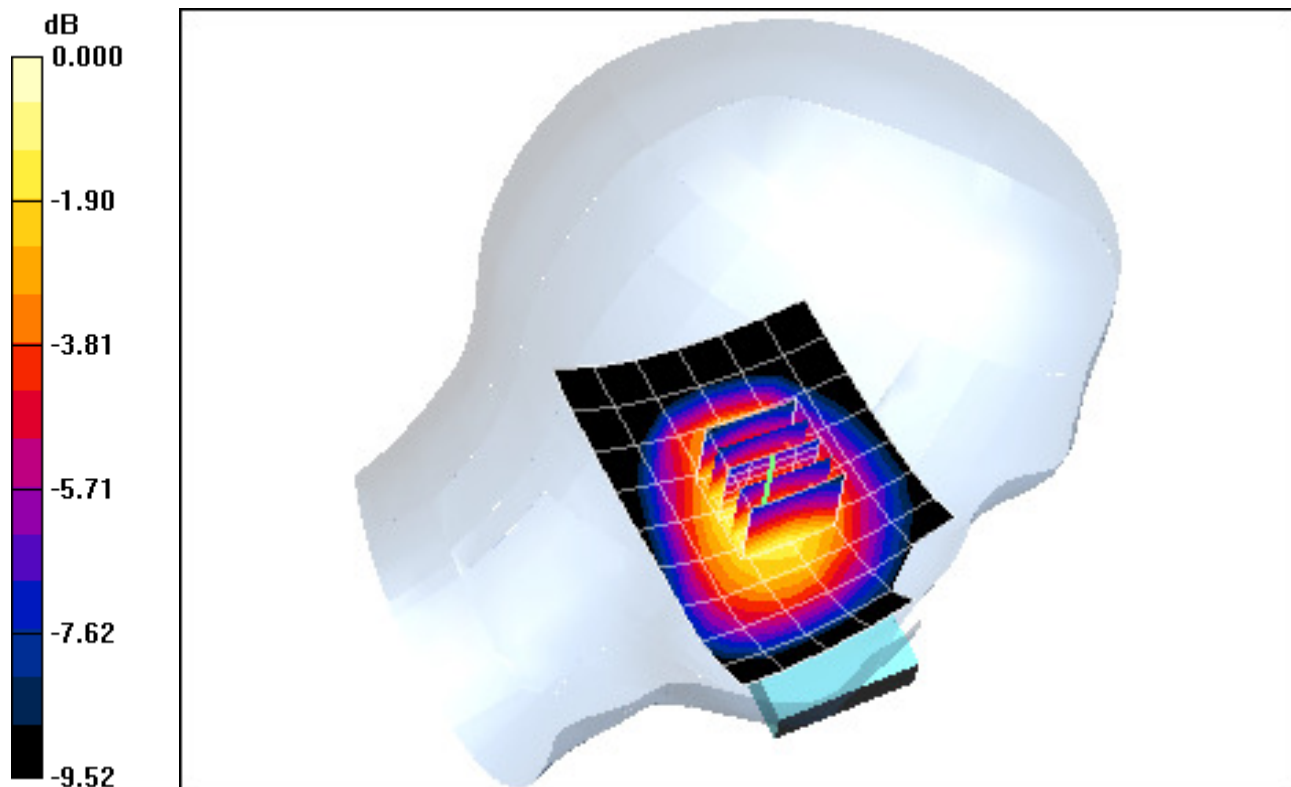
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 6.35 V/m

Peak SAR (extrapolated) = 0.089 W/kg

SAR(1 g) = 0.068 mW/g; SAR(10 g) = 0.050 mW/g



0 dB = 0.077mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium: 835 Brain; Medium parameters used (interpolated):
 $f = 836.6 \text{ MHz}$; $\sigma = 0.885 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Right Section

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 1/21/2009
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 850, Right Head, Slide Out, Touch, Mid.ch

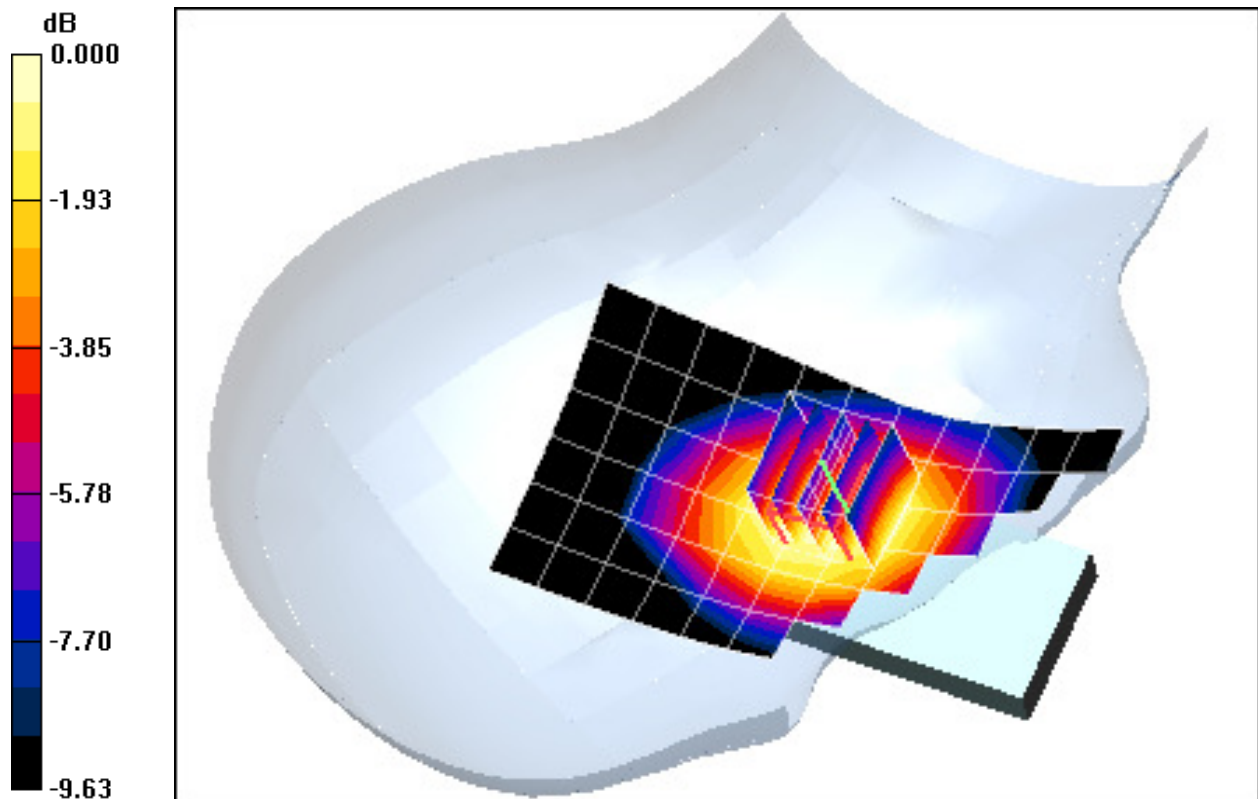
Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 4.92 V/m

Peak SAR (extrapolated) = 0.192 W/kg

SAR(1 g) = 0.147 mW/g; SAR(10 g) = 0.108 mW/g



0 dB = 0.162mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Brain; Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.885 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 850, Right Head, Slide Out, Tilt, Mid.ch

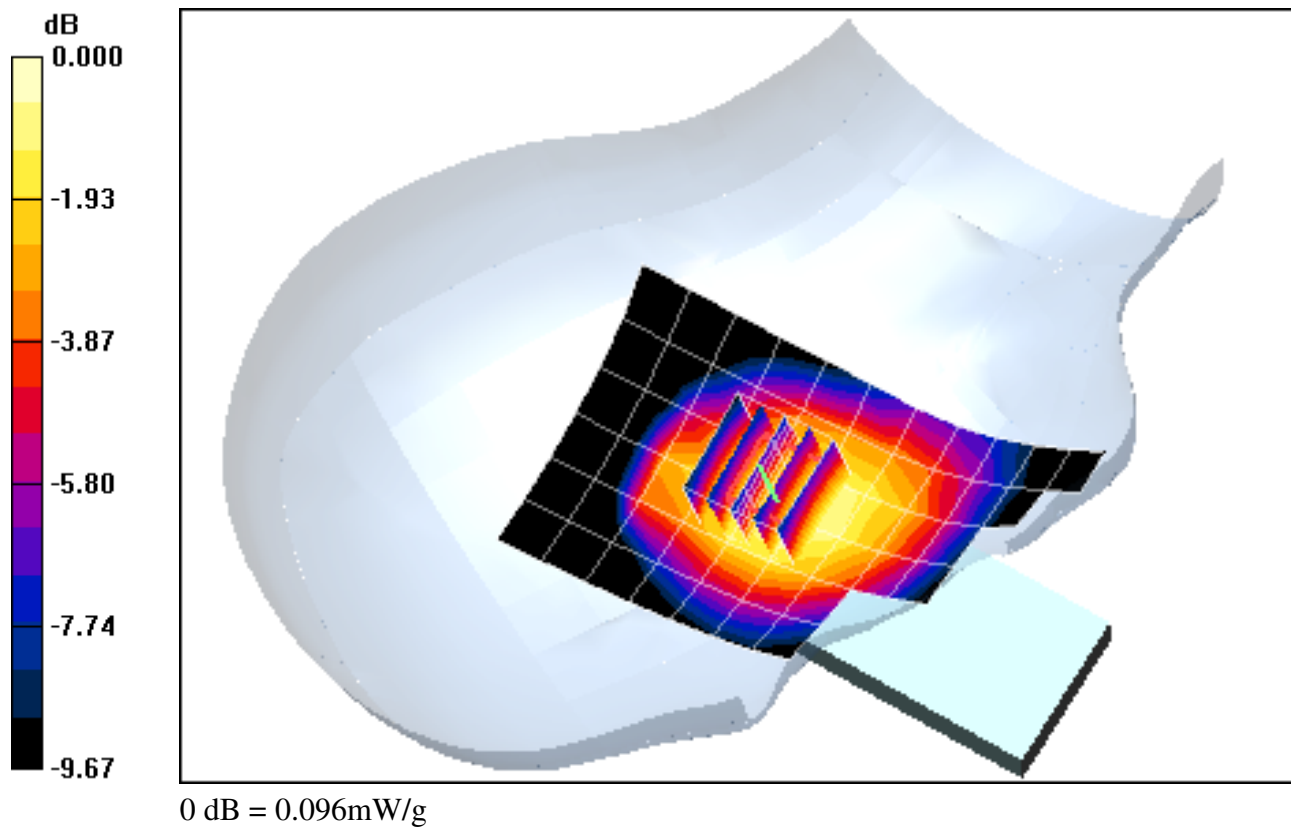
Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 7.11 V/m

Peak SAR (extrapolated) = 0.113 W/kg

SAR(1 g) = 0.085 mW/g; SAR(10 g) = 0.062 mW/g



PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Brain; Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.885 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 850, Left Head, Slide Out, Touch, Mid.ch

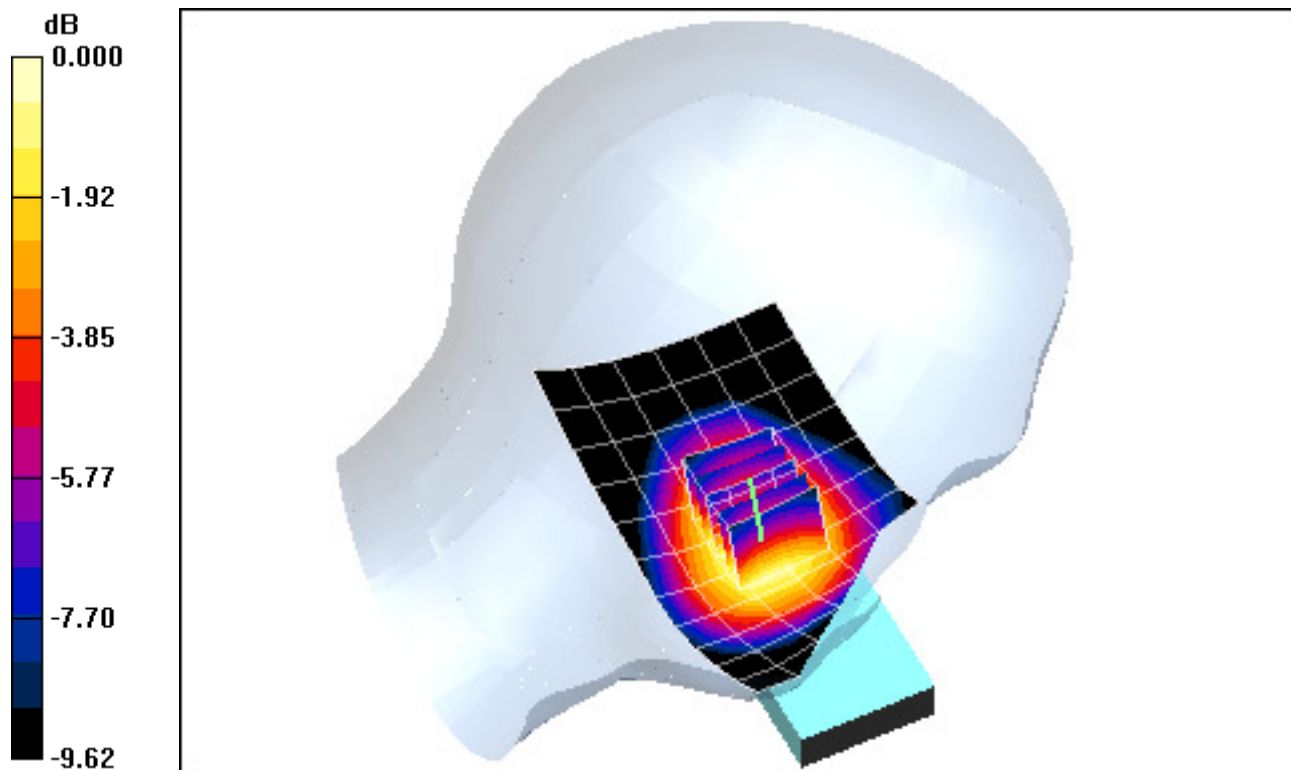
Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 4.62 V/m

Peak SAR (extrapolated) = 0.169 W/kg

SAR(1 g) = 0.134 mW/g; SAR(10 g) = 0.098 mW/g



0 dB = 0.147mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Brain; Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.885 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 850, Left Head, Slide Out, Tilt, Mid.ch

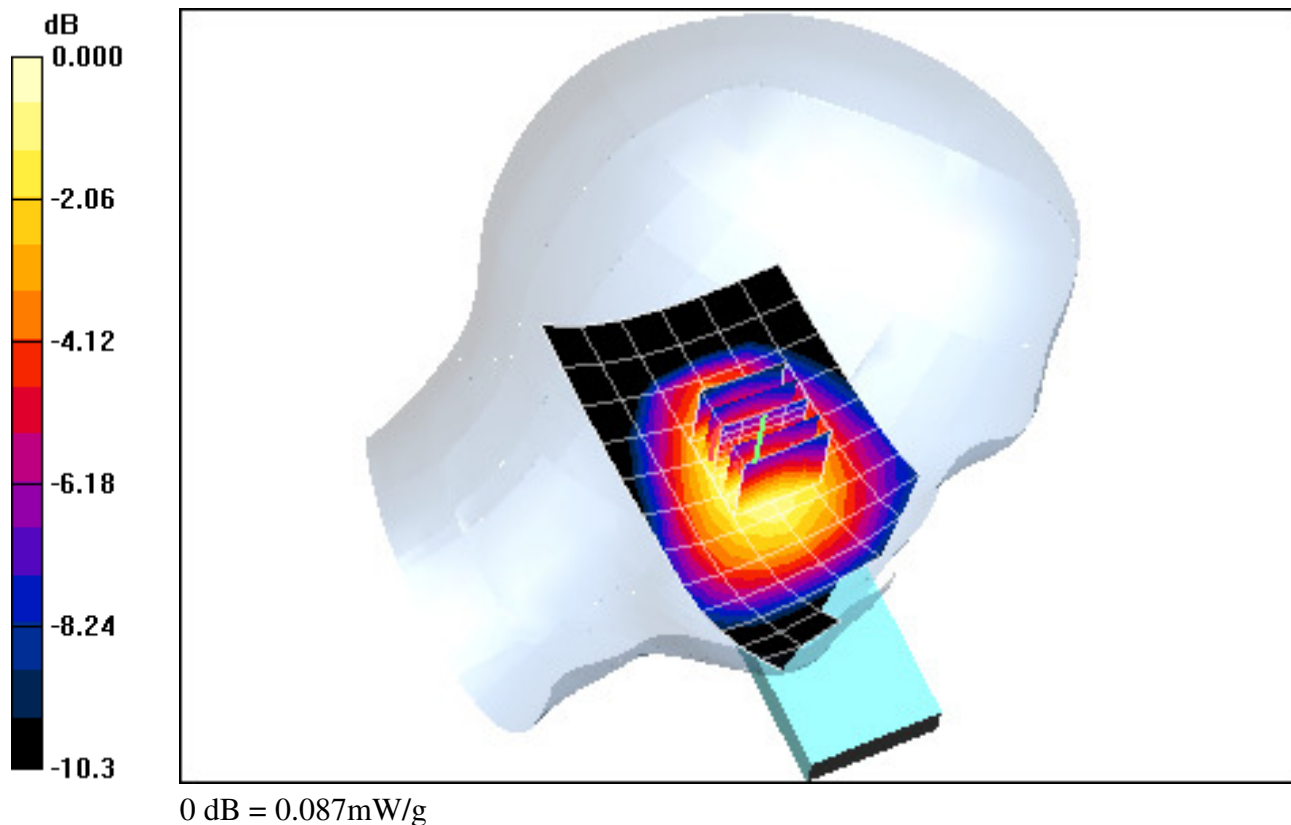
Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 6.57 V/m

Peak SAR (extrapolated) = 0.103 W/kg

SAR(1 g) = 0.078 mW/g; SAR(10 g) = 0.056 mW/g



PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Brain; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.35 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 1900, Right Head, Slide In, Touch, Mid.ch

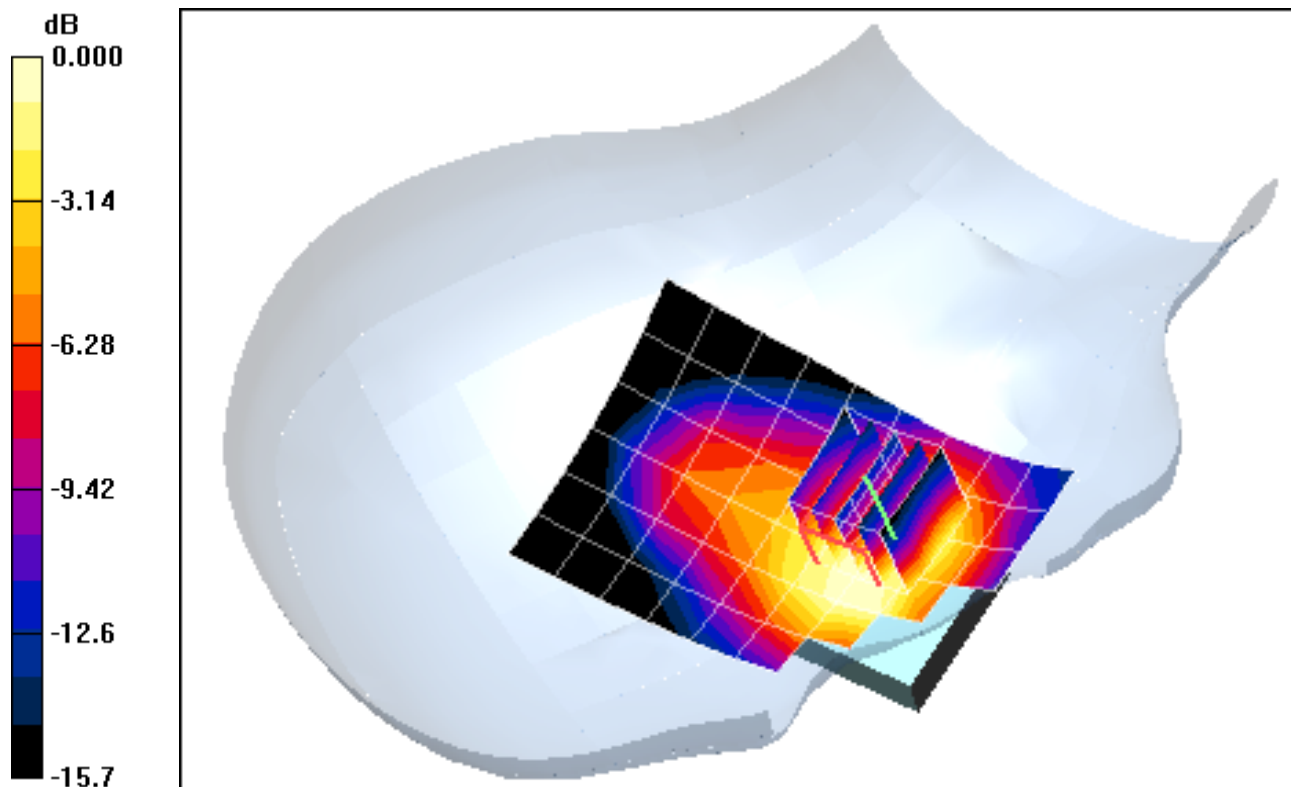
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 5.87 V/m

Peak SAR (extrapolated) = 0.328 W/kg

SAR(1 g) = 0.212 mW/g; SAR(10 g) = 0.133 mW/g



0 dB = 0.248mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Brain; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.35 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 1900, Right Head, Slide In, Tilt, Mid.ch

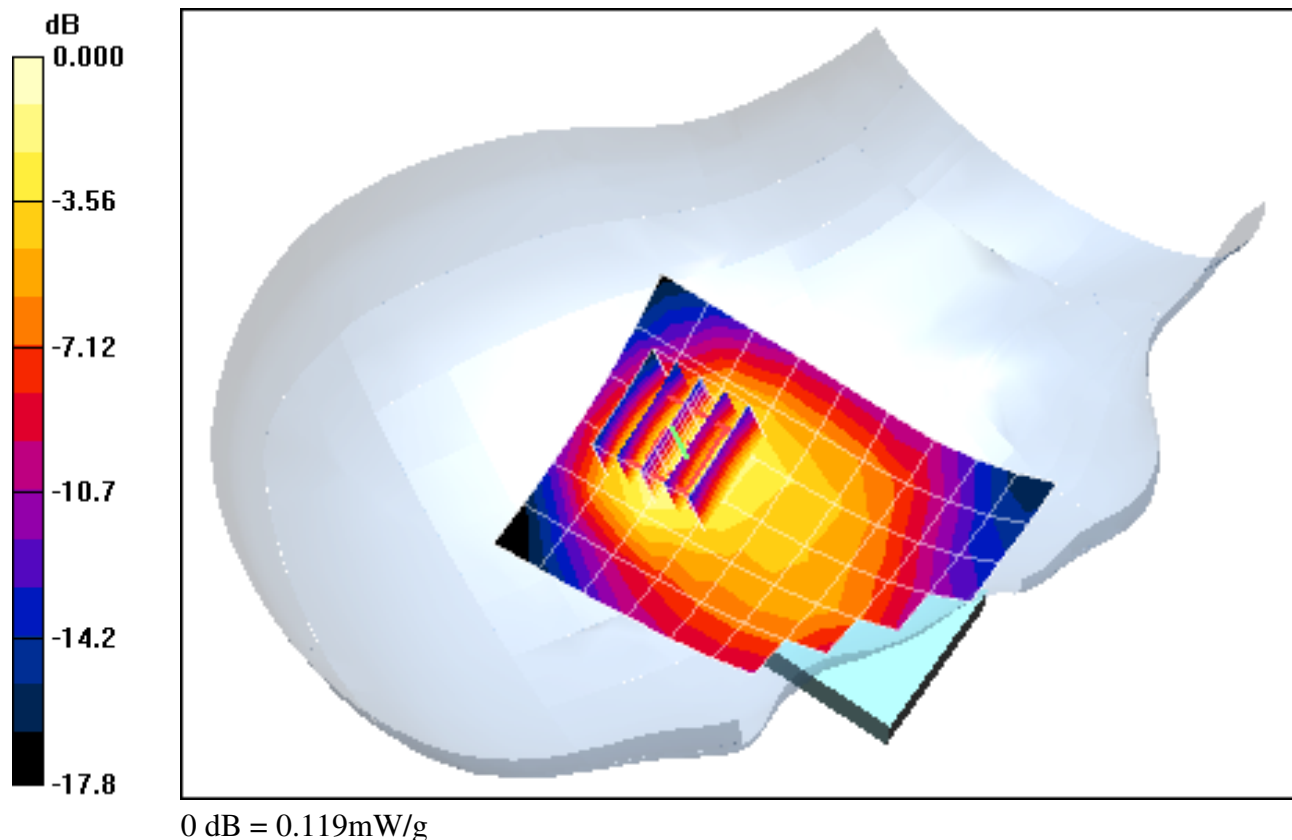
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 9.08 V/m

Peak SAR (extrapolated) = 0.164 W/kg

SAR(1 g) = 0.103 mW/g; SAR(10 g) = 0.060 mW/g



PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Brain; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.35 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 1900, Left Head, Slide In, Touch, Mid.ch

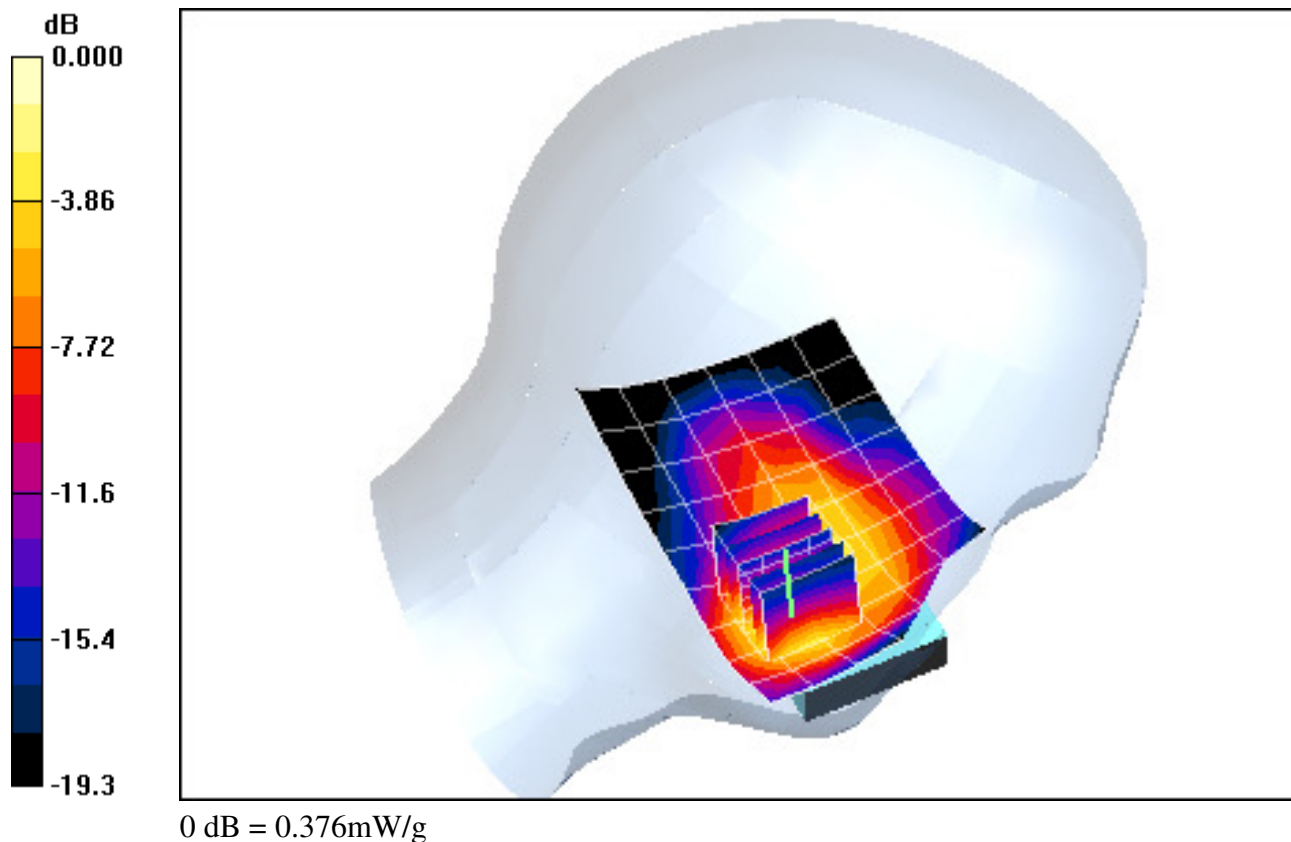
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 5.23 V/m

Peak SAR (extrapolated) = 0.549 W/kg

SAR(1 g) = 0.298 mW/g; SAR(10 g) = 0.156 mW/g



PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Brain; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.35 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 1900, Left Head, Slide In, Tilt, Mid.ch

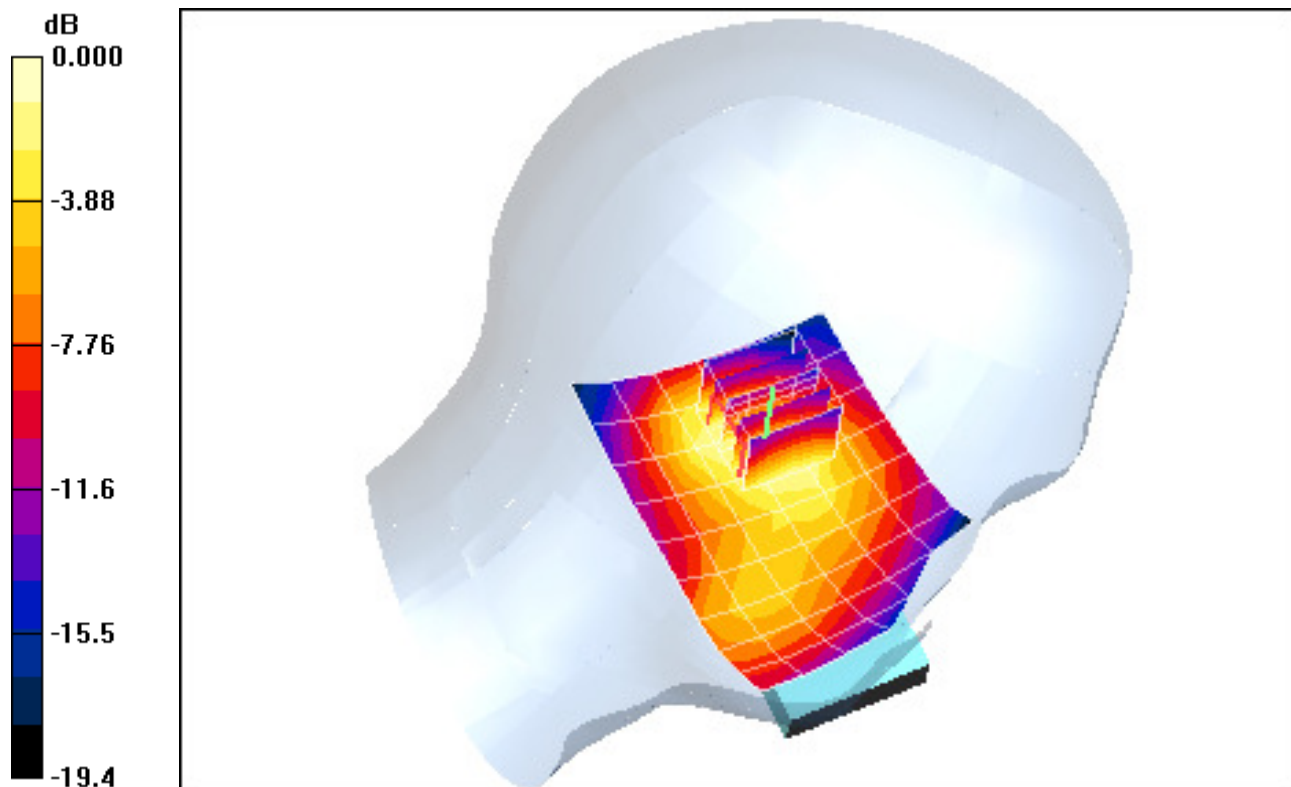
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 9.78 V/m

Peak SAR (extrapolated) = 0.191 W/kg

SAR(1 g) = 0.124 mW/g; SAR(10 g) = 0.075 mW/g



0 dB = 0.143mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Brain; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.35 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 1900, Right Head, Slide Out, Touch, Mid.ch

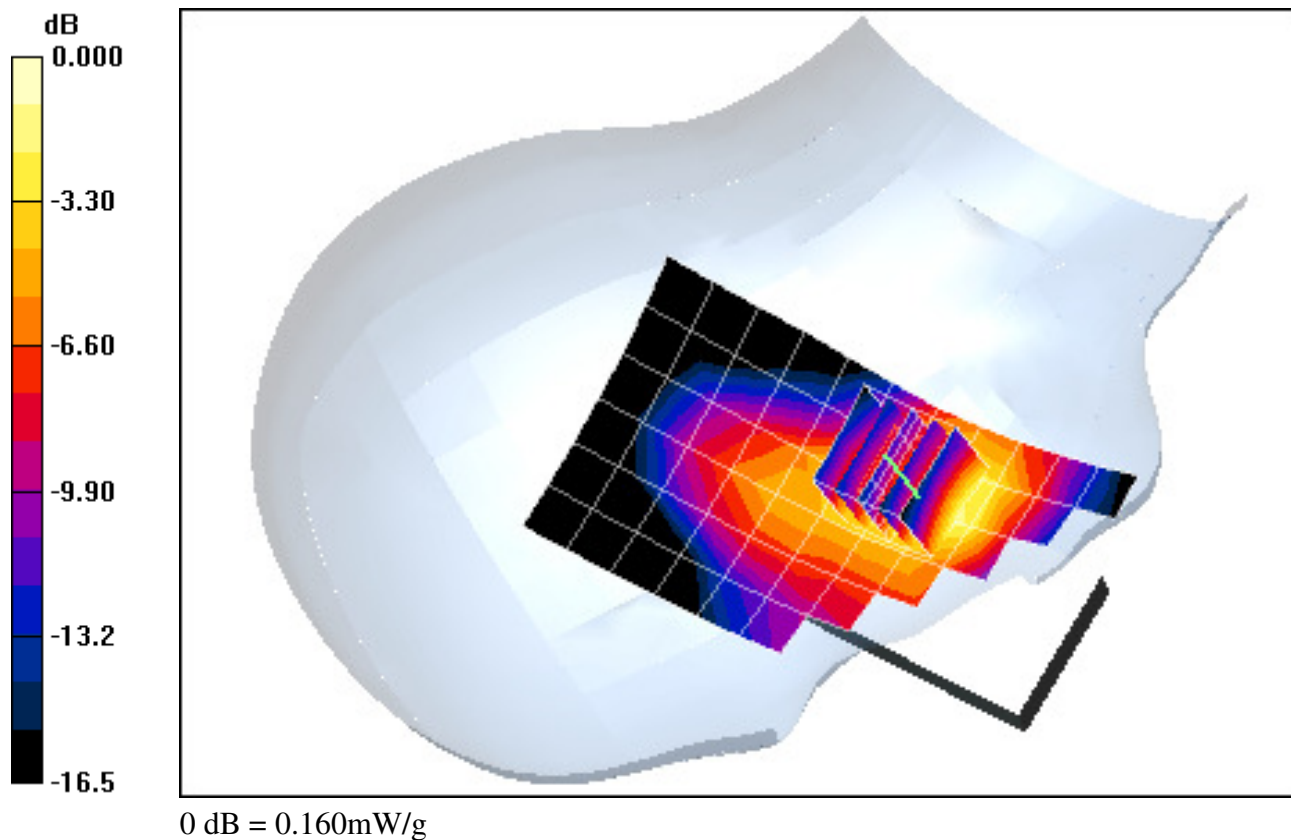
Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 3.24 V/m

Peak SAR (extrapolated) = 0.212 W/kg

SAR(1 g) = 0.131 mW/g; SAR(10 g) = 0.076 mW/g



PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Brain; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.35 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 1900, Right Head, Slide Out, Tilt, Mid.ch

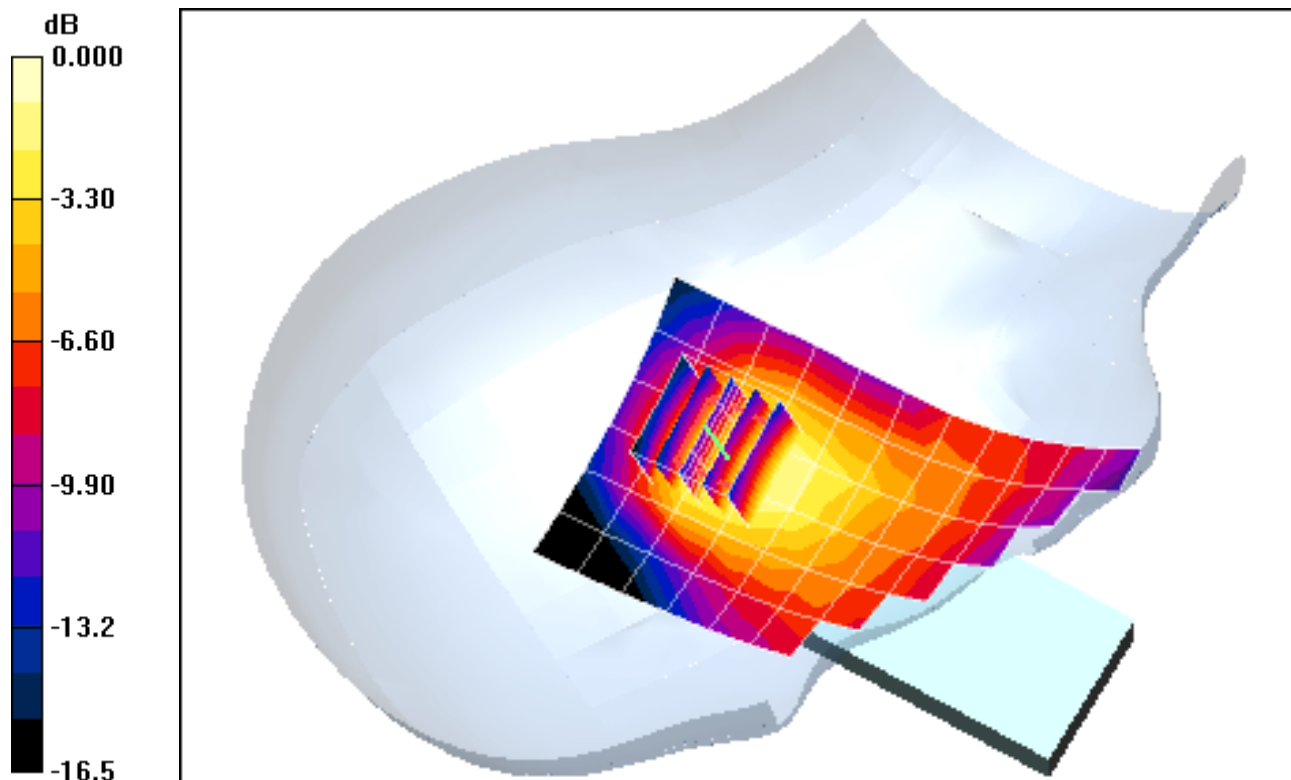
Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 6.48 V/m

Peak SAR (extrapolated) = 0.097 W/kg

SAR(1 g) = 0.065 mW/g; SAR(10 g) = 0.040 mW/g



0 dB = 0.076mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Brain; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.35 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 1900, Left Head, Slide Out, Touch, Mid.ch

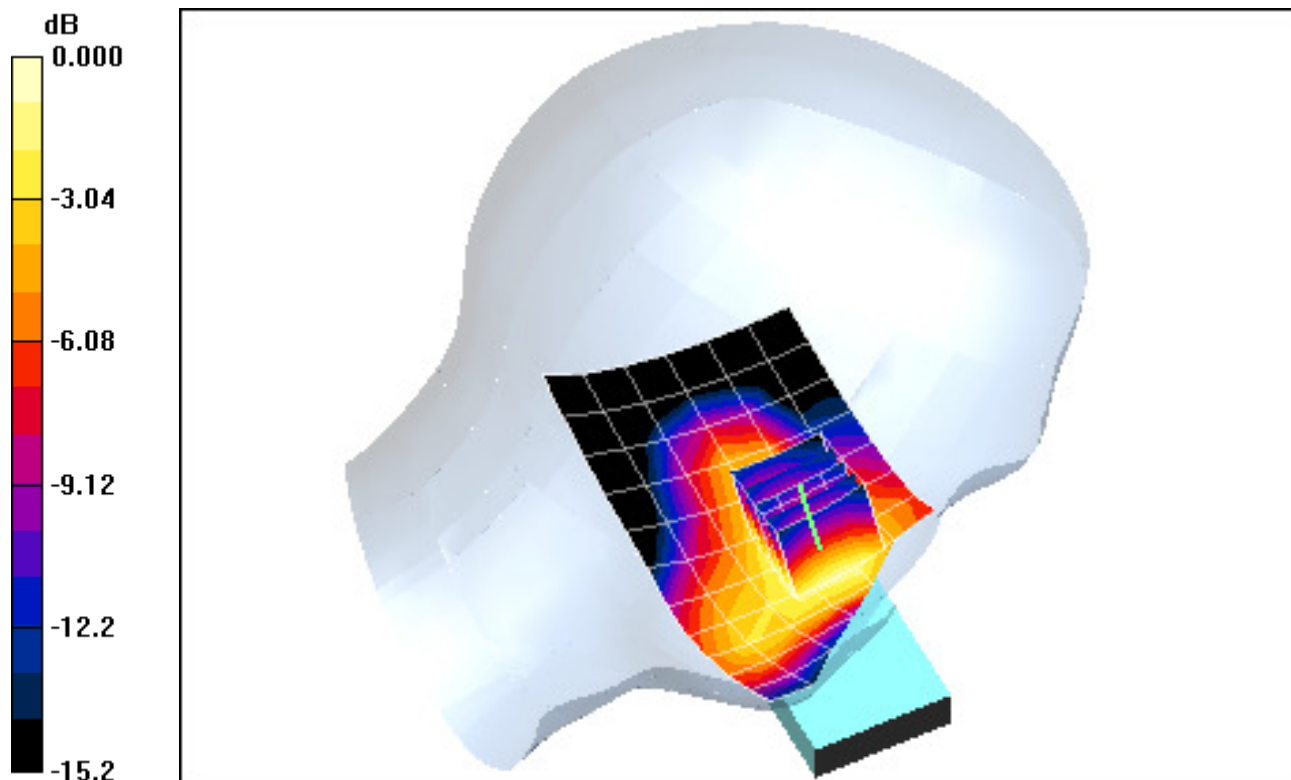
Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 3.04 V/m

Peak SAR (extrapolated) = 0.168 W/kg

SAR(1 g) = 0.111 mW/g; SAR(10 g) = 0.069 mW/g



0 dB = 0.131mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Brain; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.35 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 1900, Left Head, Slide Out, Tilt, Mid.ch

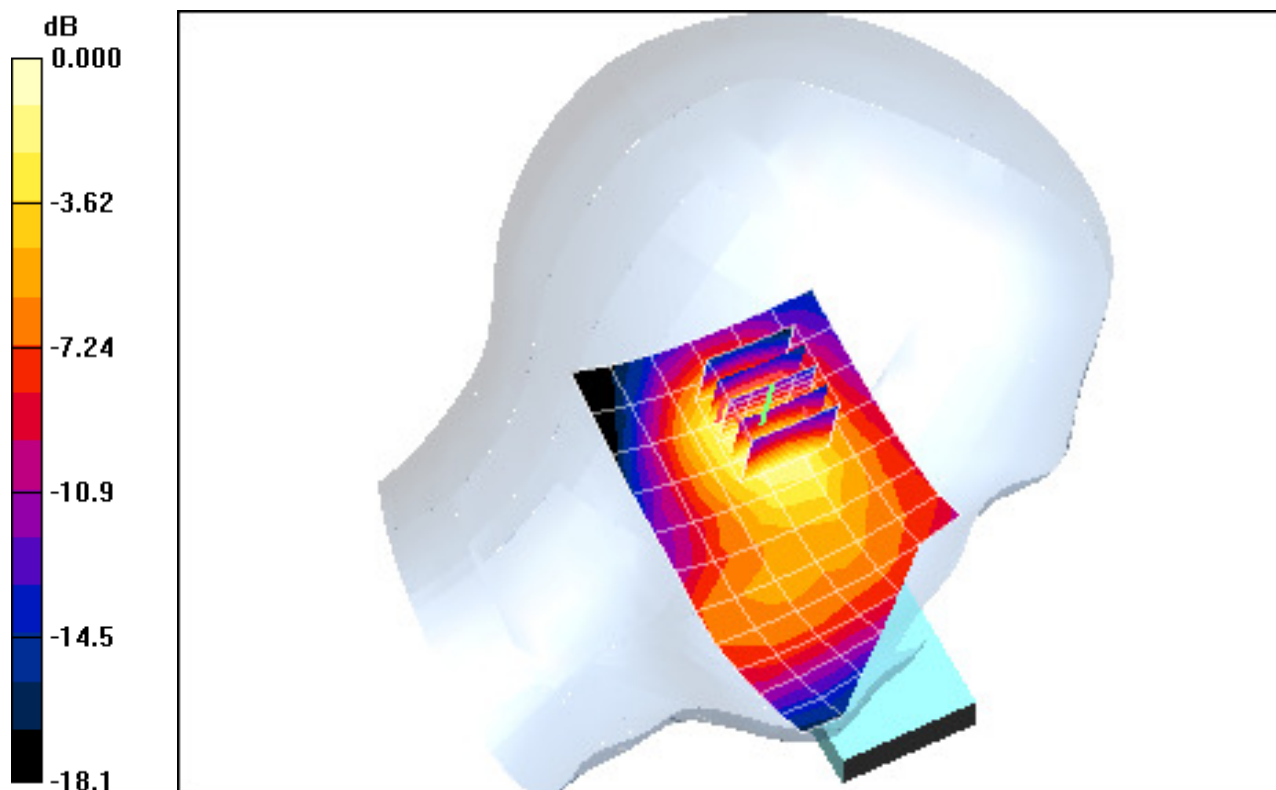
Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 6.75 V/m

Peak SAR (extrapolated) = 0.120 W/kg

SAR(1 g) = 0.077 mW/g; SAR(10 g) = 0.046 mW/g



0 dB = 0.089mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Muscle; Medium parameters used (interpolated):
 $f = 836.6 \text{ MHz}$; $\sigma = 0.981 \text{ mho/m}$; $\epsilon_r = 54.2$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-09-2009; Ambient Temp: 22.7 °C; Tissue Temp: 20.9 °C

Probe: ES3DV3 - SN3213; ConvF(5.92, 5.92, 5.92); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GPRS 850, Body SAR, Back side, Mid.ch, 2 Tx Slots

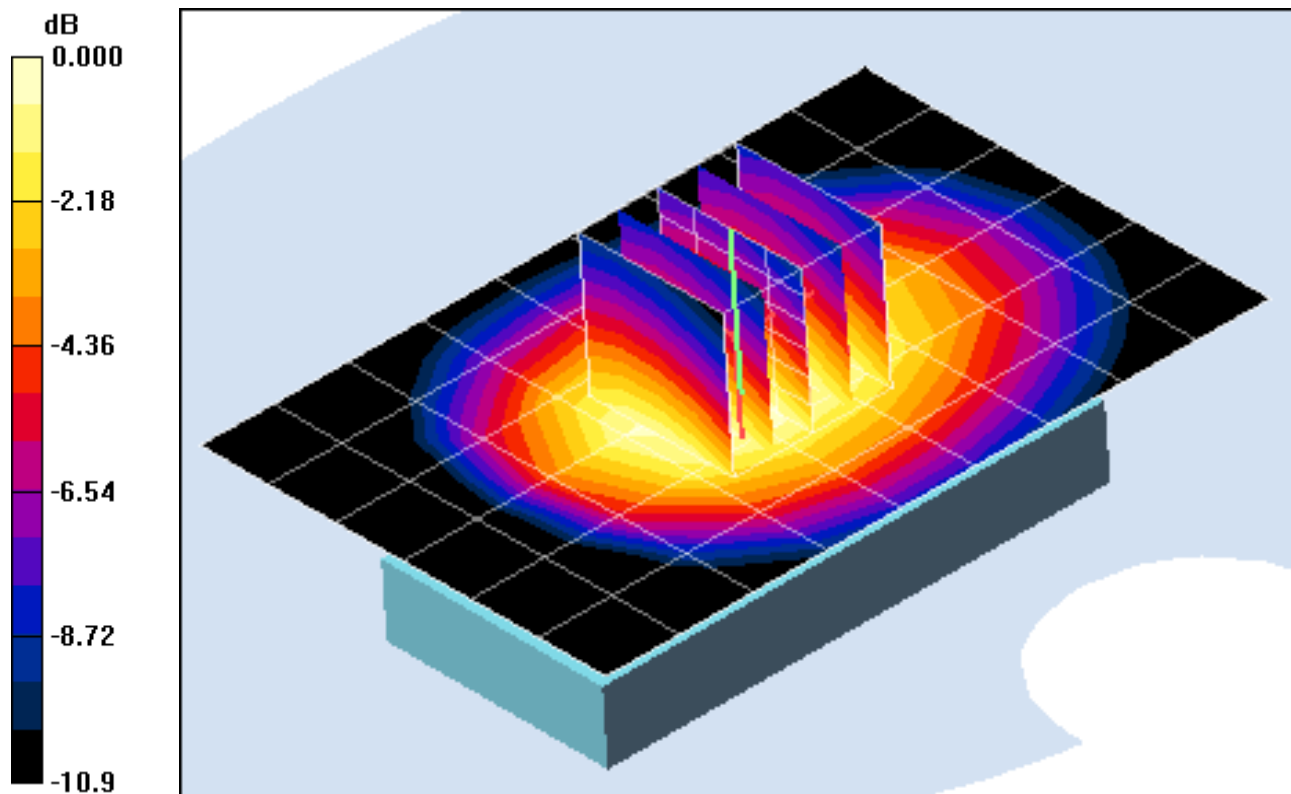
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 18.5 V/m

Peak SAR (extrapolated) = 0.428 W/kg

SAR(1 g) = 0.313 mW/g; SAR(10 g) = 0.222 mW/g



0 dB = 0.355mW/g

PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900 GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15

Medium: 1900 Muscle; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.56 \text{ mho/m}$; $\epsilon_r = 51.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-06-2009; Ambient Temp: 22.4 °C; Tissue Temp: 20.5 °C

Probe: ES3DV3 - SN3213; ConvF(4.52, 4.52, 4.52); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GPRS 1900, Body SAR, Back Side, Slide In, Mid.ch, 2 Tx Slots

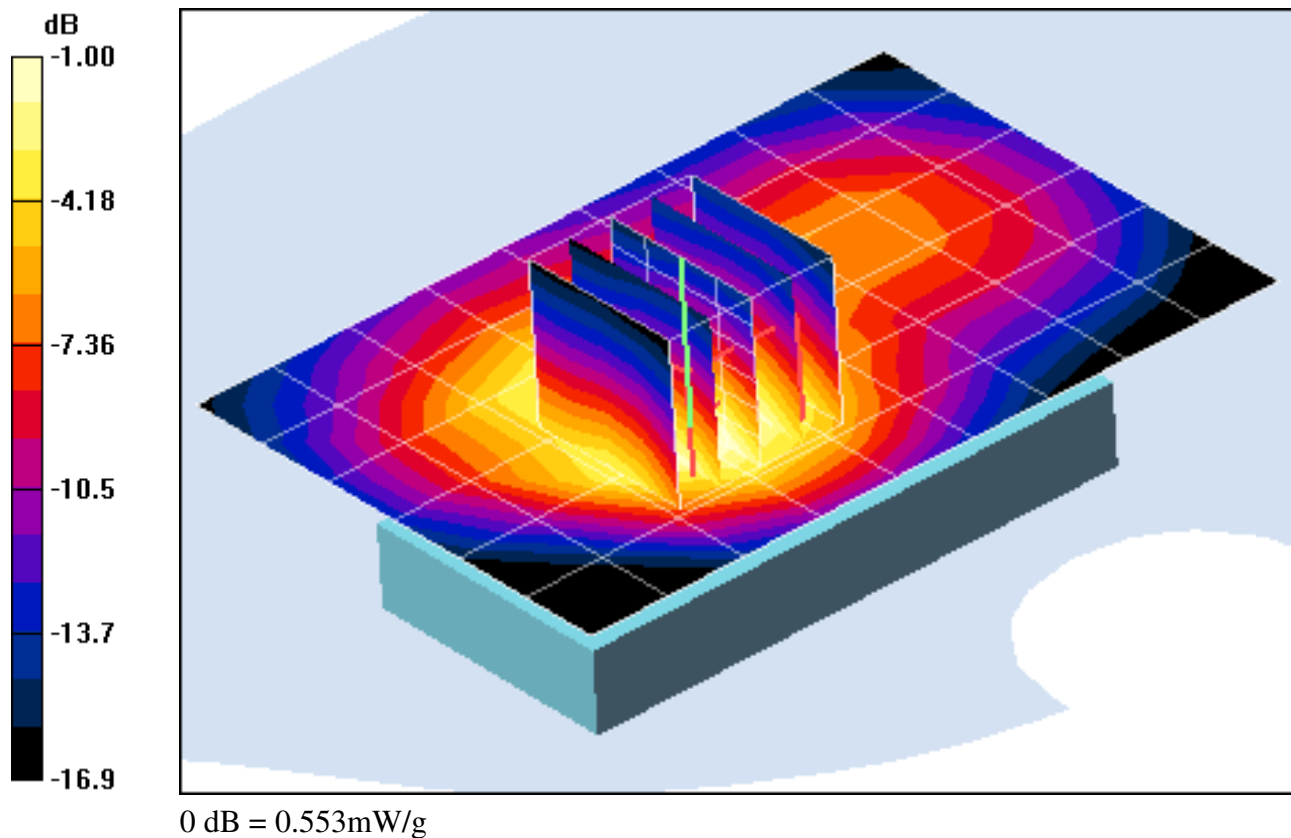
Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 12.1 V/m

Peak SAR (extrapolated) = 0.778 W/kg

SAR(1 g) = 0.447 mW/g; SAR(10 g) = 0.245 mW/g



PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Brain; Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.885 \text{ mho/m}$; $\epsilon_r = 39.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 850, Left Head, Slide In, Touch, Mid.ch

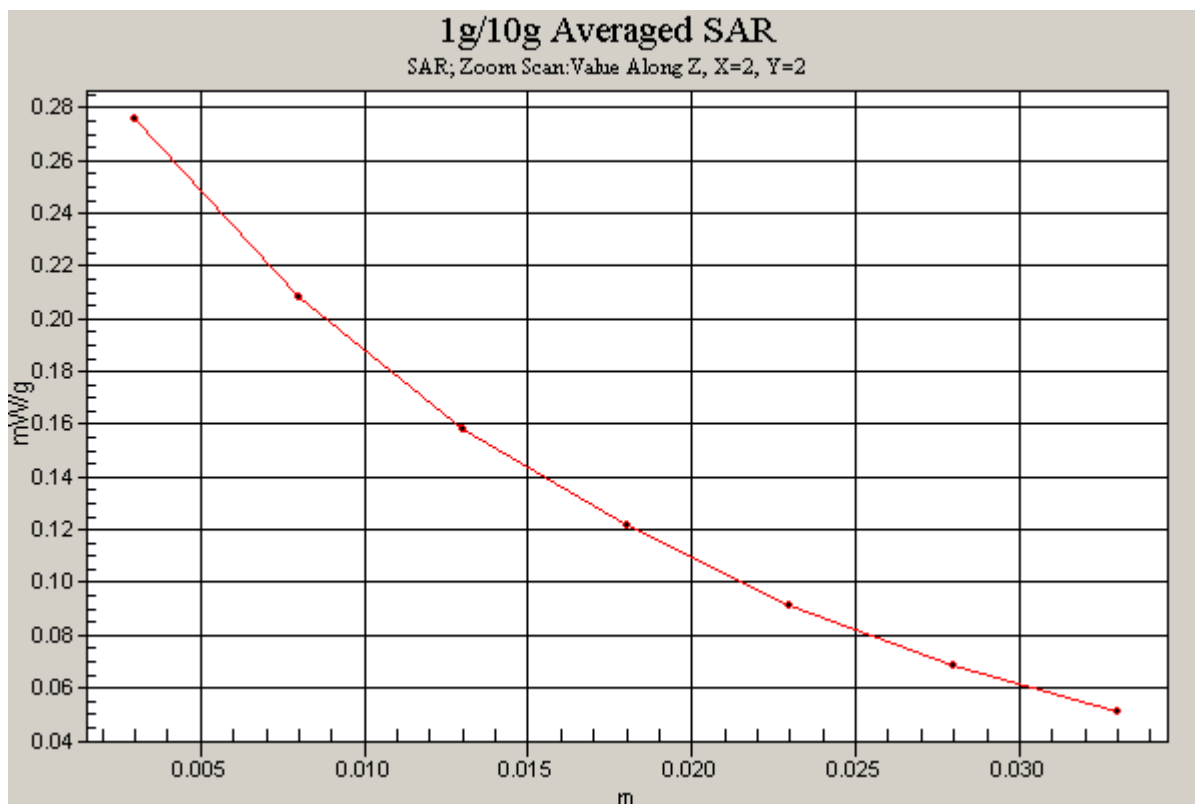
Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.37 V/m

Peak SAR (extrapolated) = 0.321 W/kg

SAR(1 g) = 0.244 mW/g; SAR(10 g) = 0.175 mW/g



PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Muscle; Medium parameters used (interpolated):
 $f = 836.6 \text{ MHz}$; $\sigma = 0.981 \text{ mho/m}$; $\epsilon_r = 54.2$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-09-2009; Ambient Temp: 22.7 °C; Tissue Temp: 20.9 °C

Probe: ES3DV3 - SN3213; ConvF(5.92, 5.92, 5.92); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GPRS 850, Body SAR, Back side, Mid.ch, 2 Tx Slots

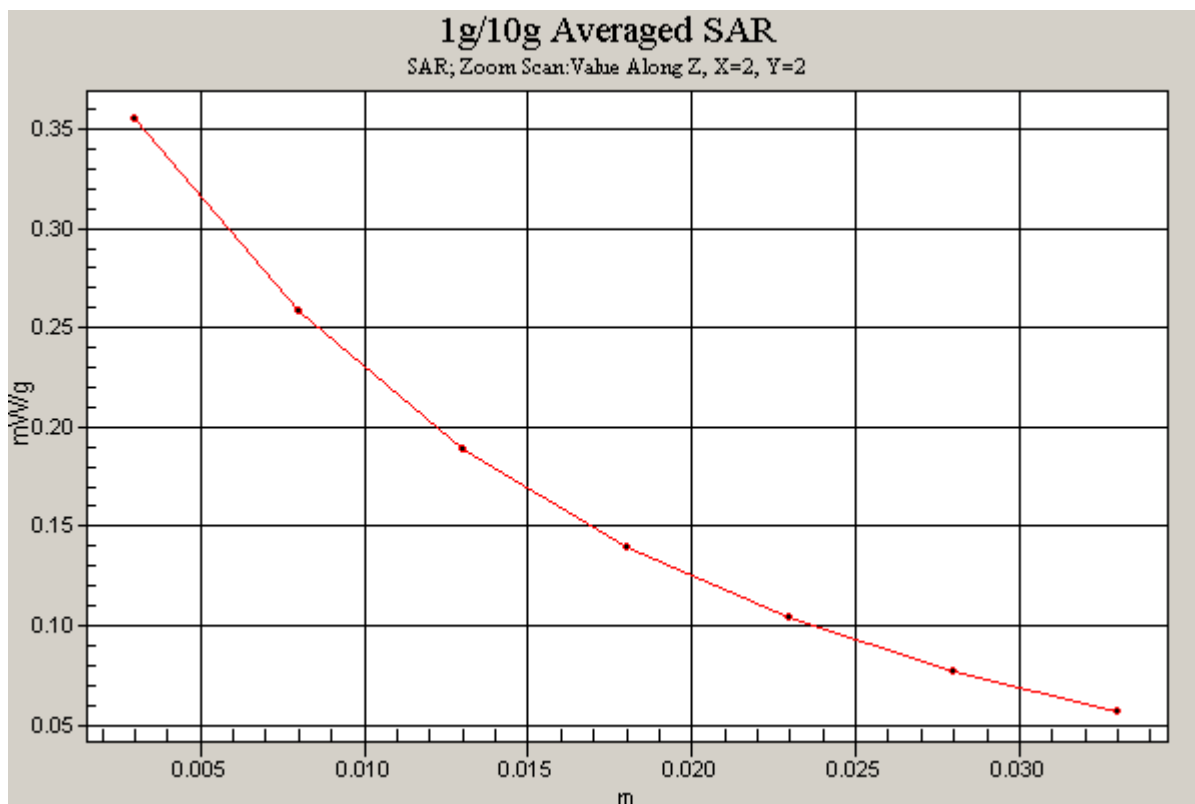
Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 18.5 V/m

Peak SAR (extrapolated) = 0.428 W/kg

SAR(1 g) = 0.313 mW/g; SAR(10 g) = 0.222 mW/g



PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Brain; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.35 \text{ mho/m}$; $\epsilon_r = 38.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GSM 1900, Left Head, Slide In, Touch, Mid.ch

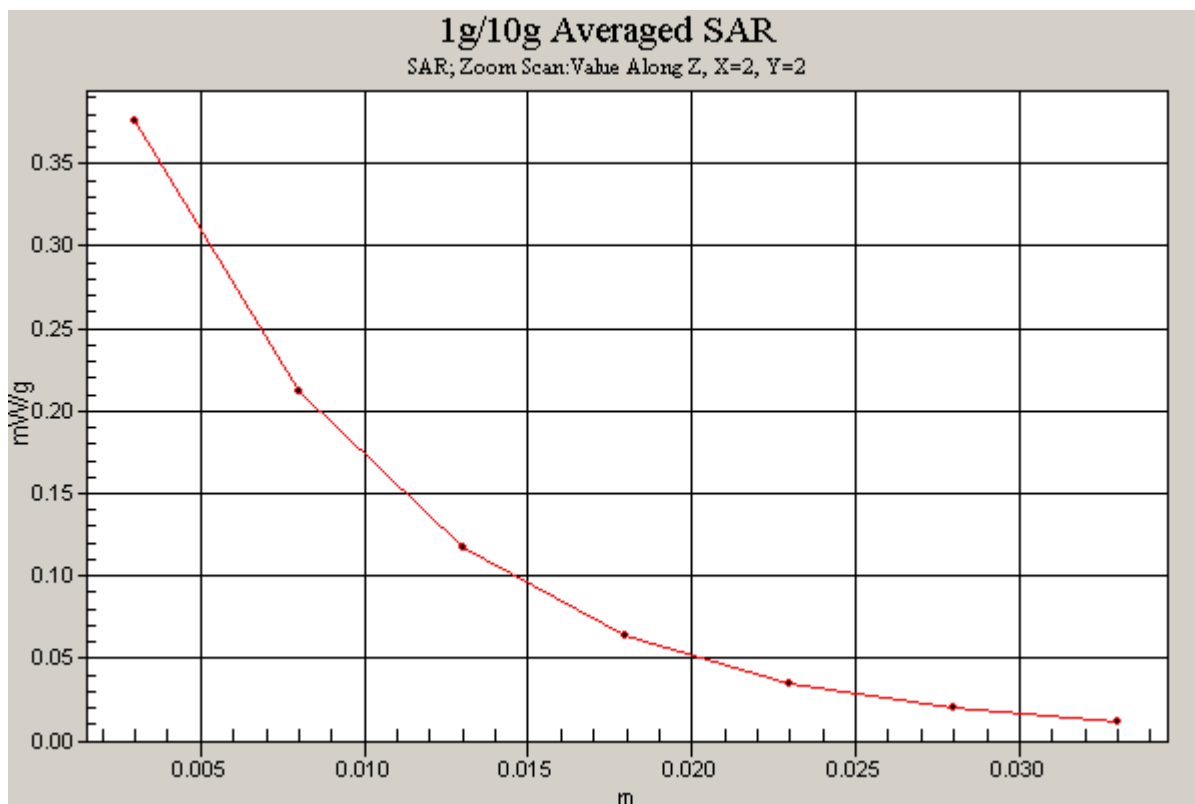
Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.23 V/m

Peak SAR (extrapolated) = 0.549 W/kg

SAR(1 g) = 0.298 mW/g; SAR(10 g) = 0.156 mW/g



PCTEST ENGINEERING LABORATORY, INC.

**DUT: GT-S5550; Type: 850/1900 GSM/GPRS Phone with Bluetooth and EDGE Rx
Serial: FG-294-A**

Communication System: GSM1900 GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15

Medium: 1900 Muscle; Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.56 \text{ mho/m}$; $\epsilon_r = 51.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-06-2009; Ambient Temp: 22.4 °C; Tissue Temp: 20.5 °C

Probe: ES3DV3 - SN3213; ConvF(4.52, 4.52, 4.52); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

Mode: GPRS 1900, Body SAR, Back side, Slide In, Mid.ch, 2 Tx Slots

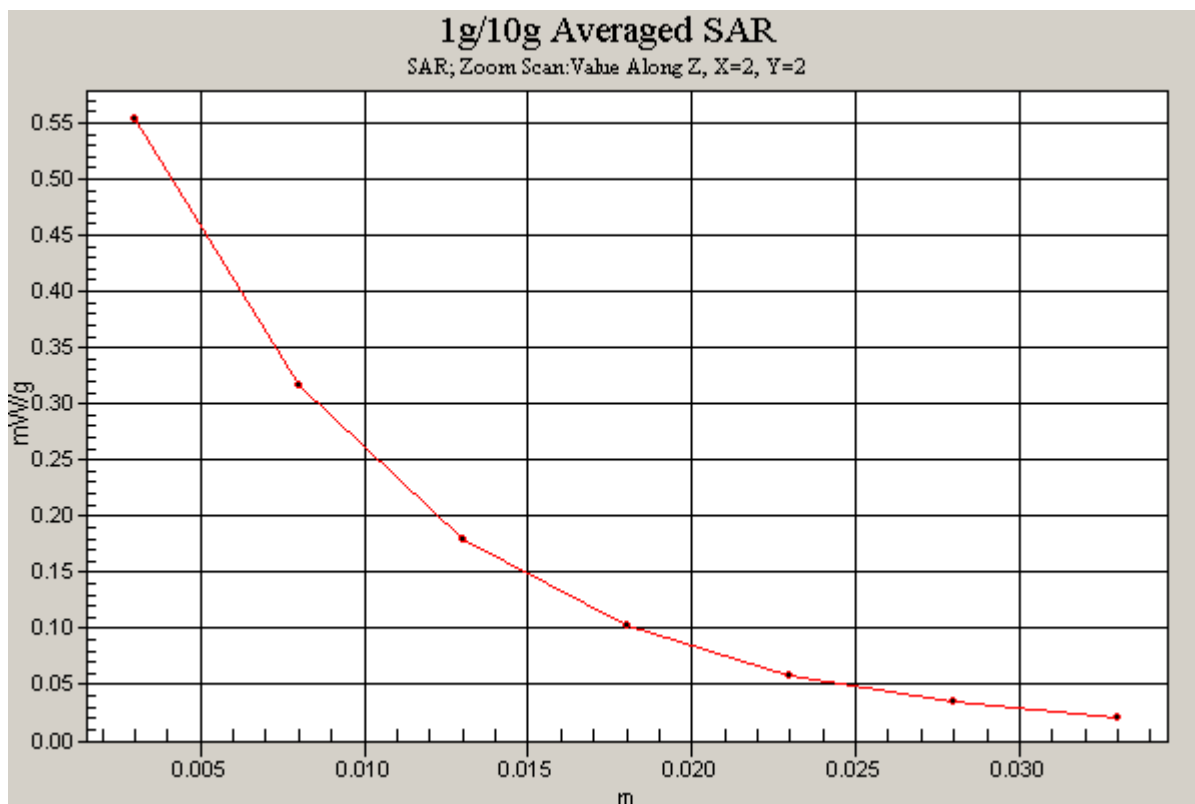
Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.1 V/m

Peak SAR (extrapolated) = 0.778 W/kg

SAR(1 g) = 0.447 mW/g; SAR(10 g) = 0.245 mW/g



APPENDIX B: DIPOLE VALIDATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: 835MHz SAR Validation Dipole; Type: D835V2; Serial: 4d026

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Brain; Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.883 \text{ mho/m}$; $\epsilon_r = 39.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-09-2009; Ambient Temp: 22.5 °C; Tissue Temp: 20.8 °C

Probe: ES3DV3 - SN3213; ConvF(5.94, 5.94, 5.94); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

835MHz SAR Dipole Validation

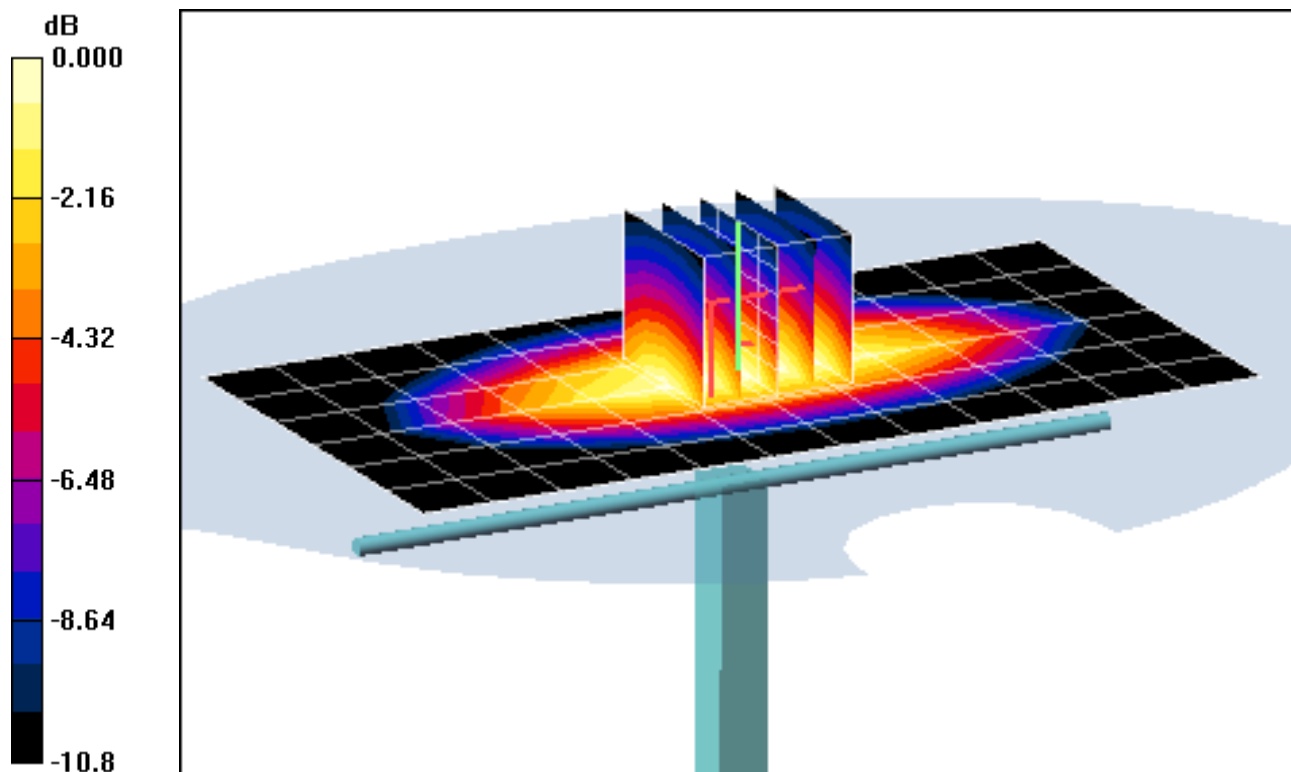
Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

SAR(1 g) = 0.975 mW/g; SAR(10 g) = 0.633 mW/g

Deviation = 3.07 %



0 dB = 1.14mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d080

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Brain; Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.38 \text{ mho/m}$; $\epsilon_r = 38.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-06-2009; Ambient Temp: 22.3 °C; Tissue Temp: 20.4 °C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/15/2009

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 1/21/2009

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 172

1900MHz SAR Dipole Validation

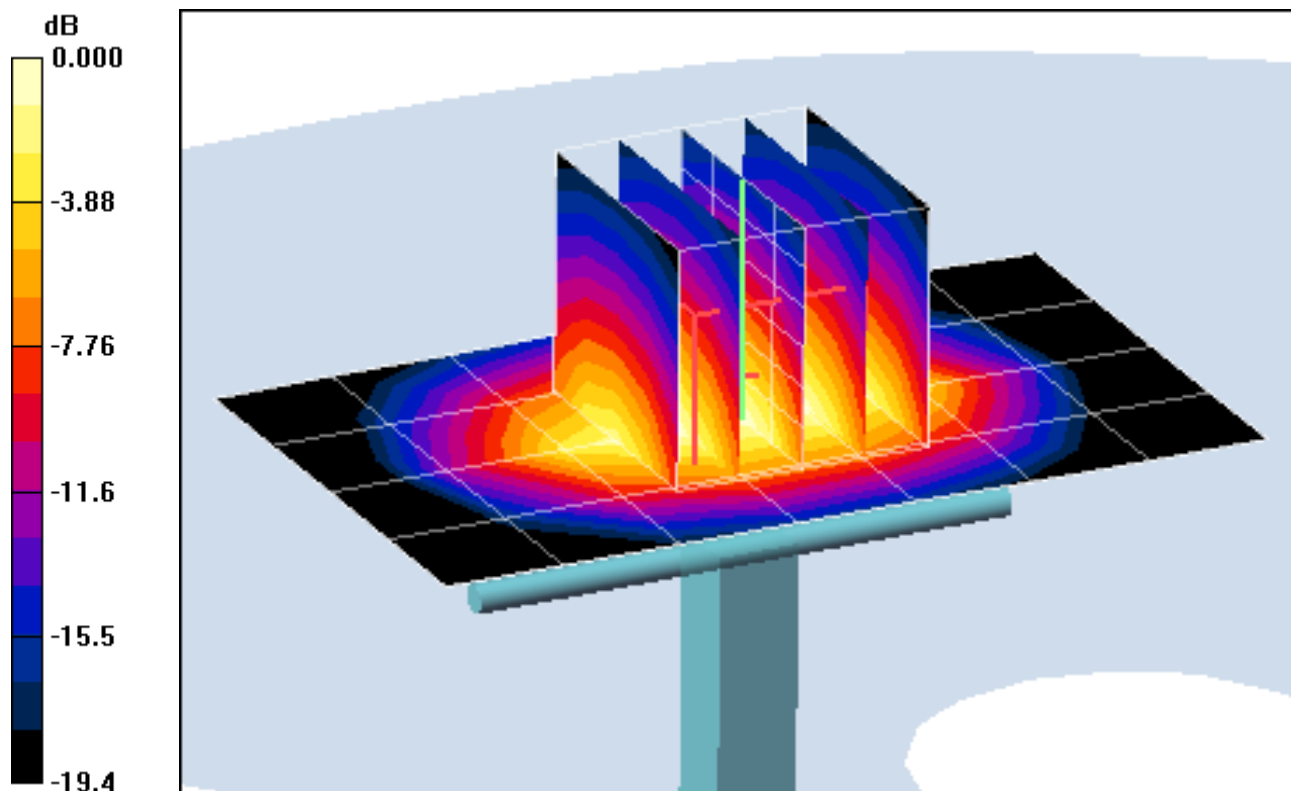
Area Scan (5x8x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

SAR(1 g) = 4.1 mW/g; SAR(10 g) = 2.05 mW/g

Deviation = 2.24 %



0 dB = 5.28mW/g

APPENDIX C: PROBE CALIBRATION



Accredited by the Swiss Accreditation Service (SAS)
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3213_Apr09**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3213**

Calibration procedure(s) **QA CAL-01.v6 and QA CAL-23.v3**
Calibration procedure for dosimetric E-field probes

Calibration date: **April 15, 2009**

Condition of the calibrated item **In Tolerance**

OK
 4/23/09
 SL

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Fin Bornhoff	R&D Director	

Issued: April 15, 2009

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
Polarization ϕ	ϕ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}:** Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}:** DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters:** Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy):** in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset:** The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3213

Manufactured:	October 14, 2008
Calibrated:	April 15, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3213**Sensitivity in Free Space^A****Diode Compression^B**

NormX	1.23 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	90 mV
NormY	1.40 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	92 mV
NormZ	1.36 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	94 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect**TSL 835 MHz Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR _{be} [%]	Without Correction Algorithm	10.4	6.1
SAR _{be} [%]	With Correction Algorithm	0.8	0.5

TSL 1750 MHz Typical SAR gradient: 10 % per mm

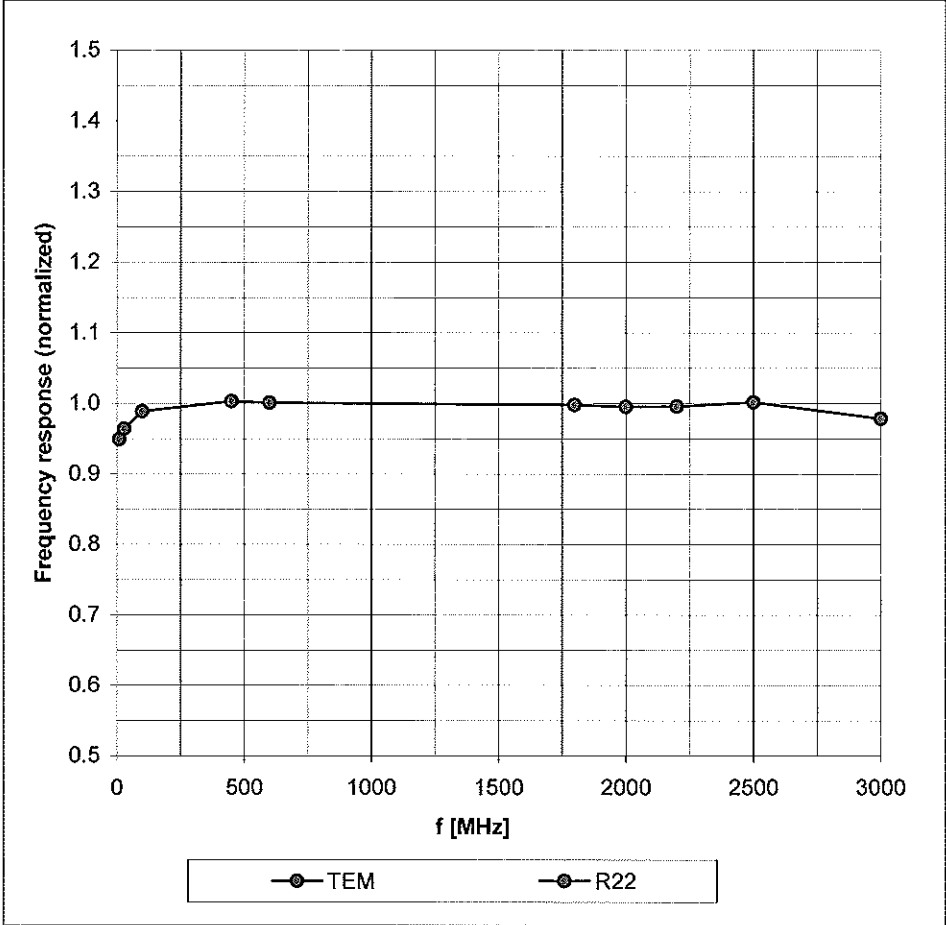
Sensor Center to Phantom Surface Distance		3.0 mm	4.0 mm
SAR _{be} [%]	Without Correction Algorithm	9.6	5.8
SAR _{be} [%]	With Correction Algorithm	0.8	0.6

Sensor OffsetProbe Tip to Sensor Center **2.0 mm**

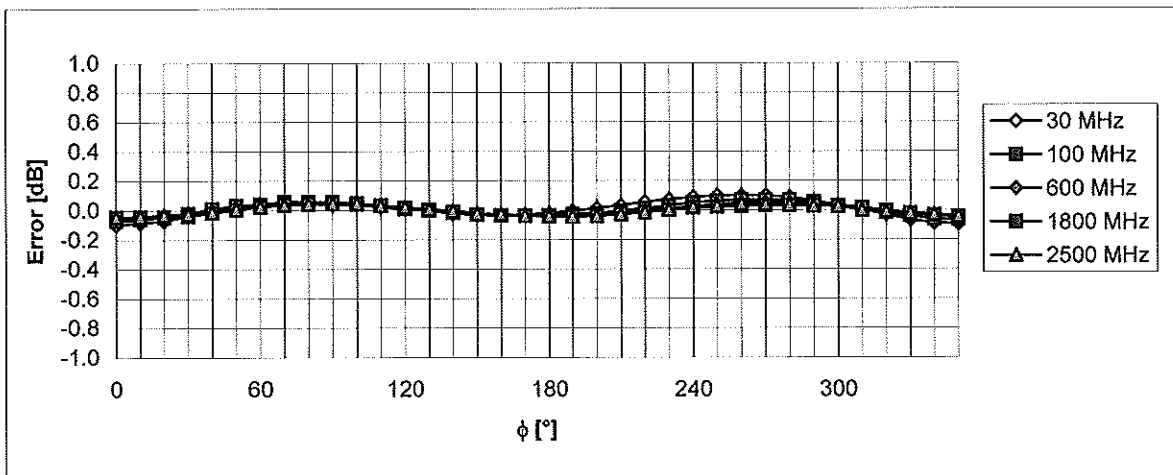
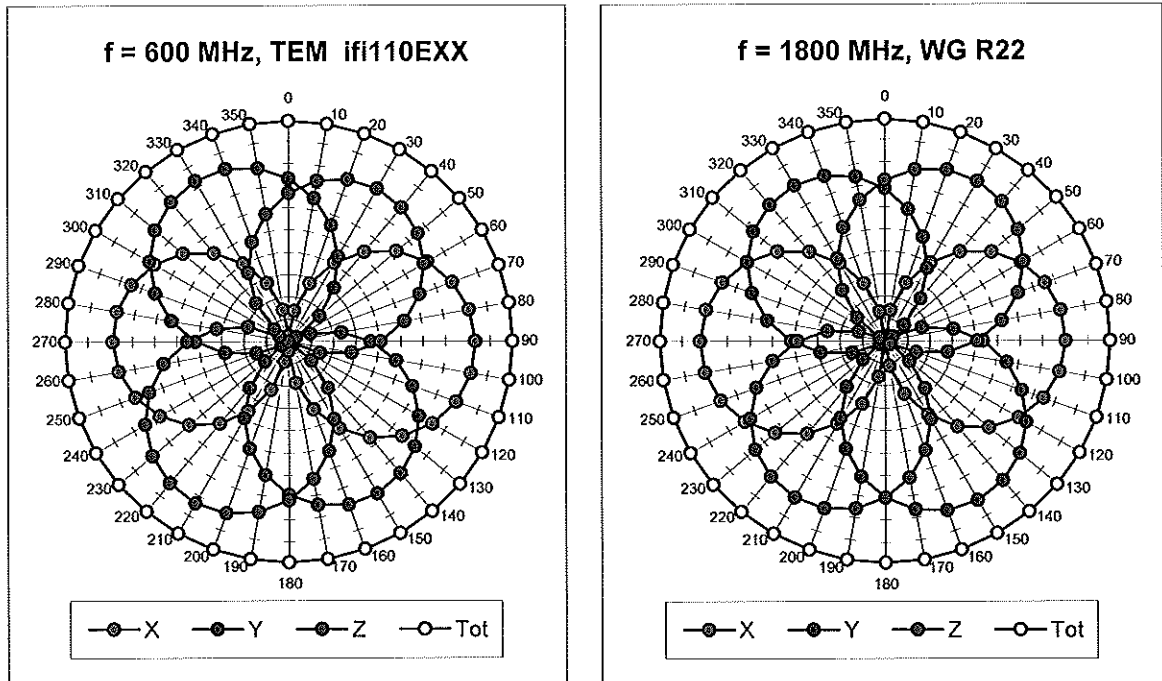
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).^B Numerical linearization parameter: uncertainty not required.

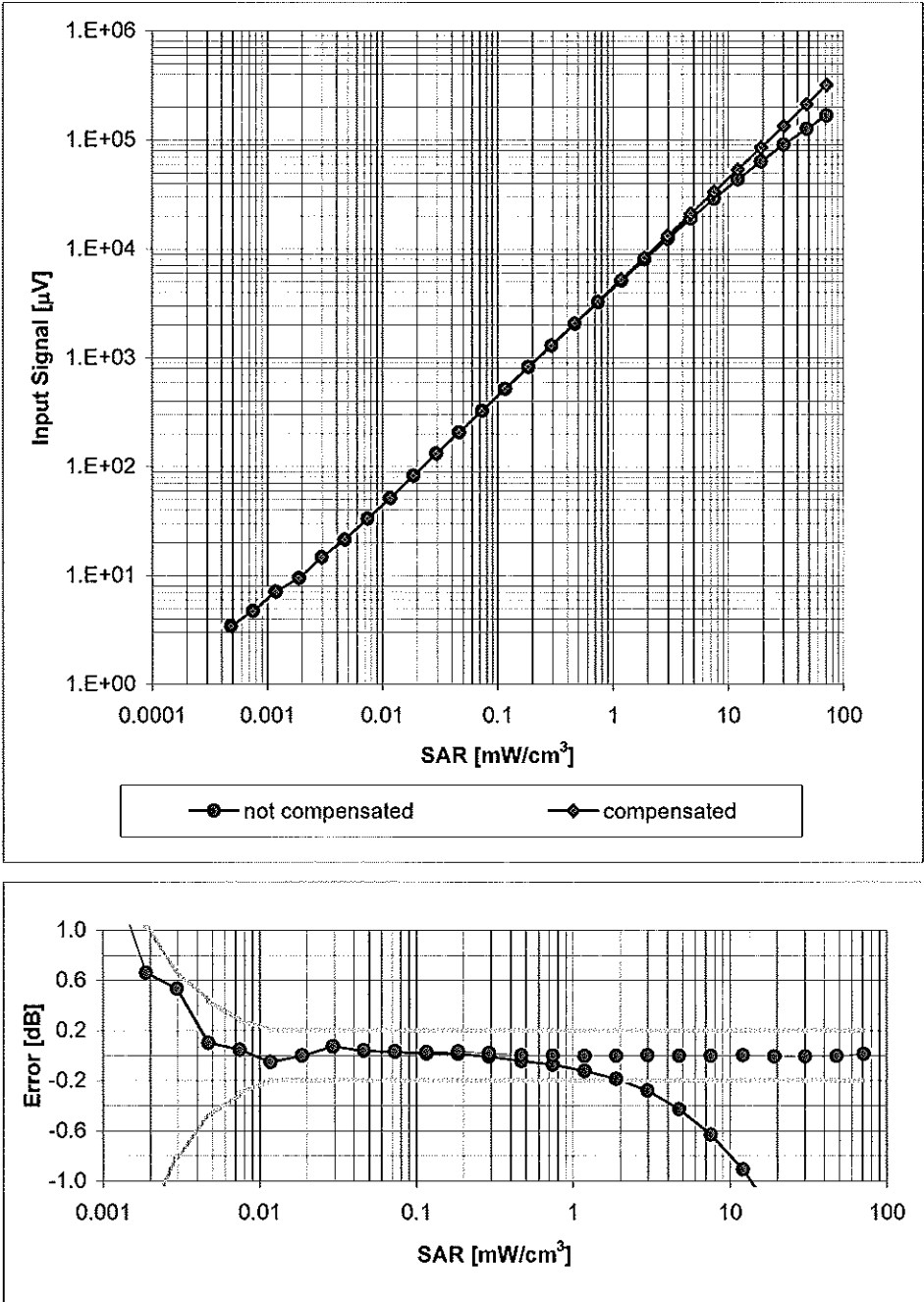
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

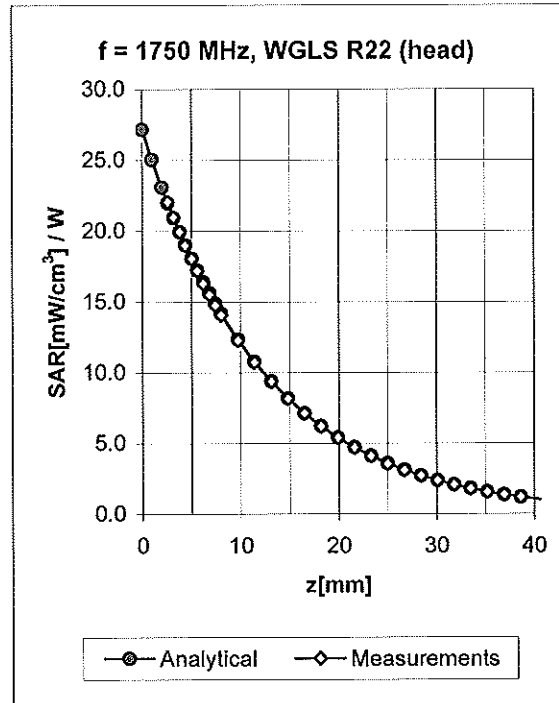
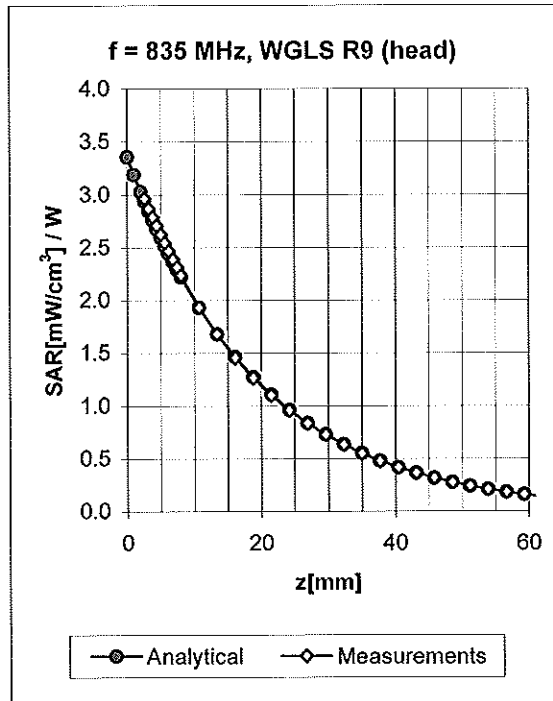
Receiving Pattern (ϕ), $\vartheta = 0^\circ$ Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range f(SAR_{head})
(Waveguide R22, f = 1800 MHz)



Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment

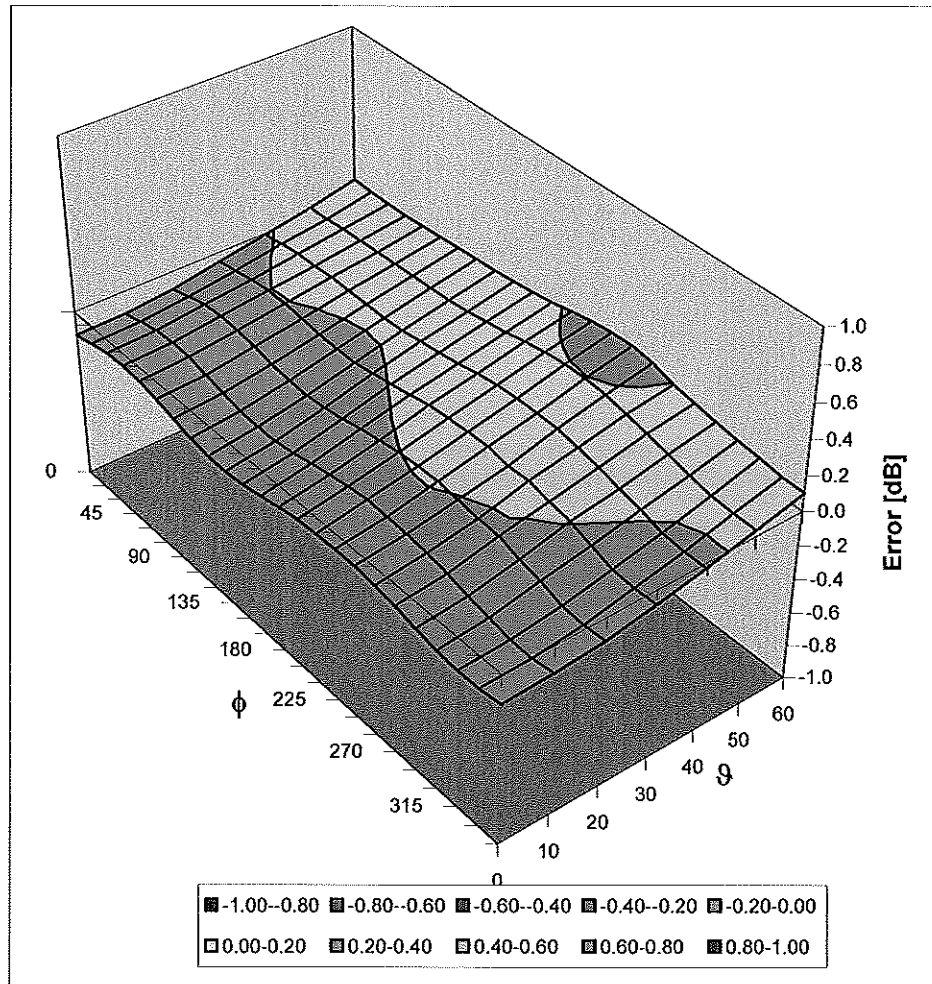


f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.85	1.13	5.94 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.51	1.48	5.23 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.46	1.60	5.02 ± 11.0% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.75	1.21	5.92 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.35	2.08	4.82 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.33	2.33	4.52 ± 11.0% (k=2)

^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Deviation from Isotropy in HSL

Error (ϕ , θ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d026_Aug09**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d026**

Calibration procedure(s) **QA CAL-05.v7
Calibration procedure for dipole validation kits**

Calibration date: **August 24, 2009**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (In house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	

Approved by:	Katja Pokovic	Technical Manager	
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Issued: August 25, 2009

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Accreditation No.: **SCS 108**

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.2 $\pm$ 6 %	0.90 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.0 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 mW / g
SAR normalized	normalized to 1W	9.48 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	9.46 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 mW / g
SAR normalized	normalized to 1W	6.20 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	6.19 mW / g $\pm$ 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature during test	(22.5 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.50 mW / g
SAR normalized	normalized to 1W	10.0 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	9.78 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.63 mW / g
SAR normalized	normalized to 1W	6.52 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	6.42 mW / g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0 Ω - 7.5 j Ω
Return Loss	- 22.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.9 Ω - 8.6 j Ω
Return Loss	- 20.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.388 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 17, 2004

DASY5 Validation Report for Head TSL

Date/Time: 24.08.2009 13:11:23

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d026

Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL 900 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.9$ mho/m; $\epsilon_r = 41.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

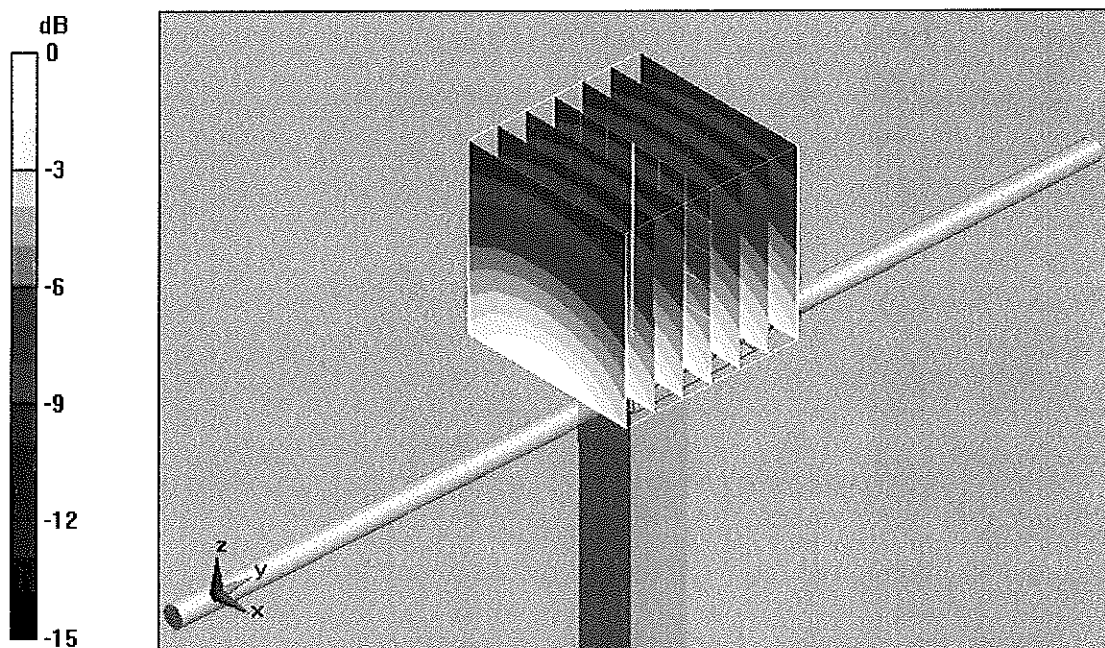
Pin=250mW; dip=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.1 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 3.55 W/kg

SAR(1 g) = 2.37 mW/g; SAR(10 g) = 1.55 mW/g

Maximum value of SAR (measured) = 2.77 mW/g



0 dB = 2.77mW/g

Impedance Measurement Plot for Head TSL

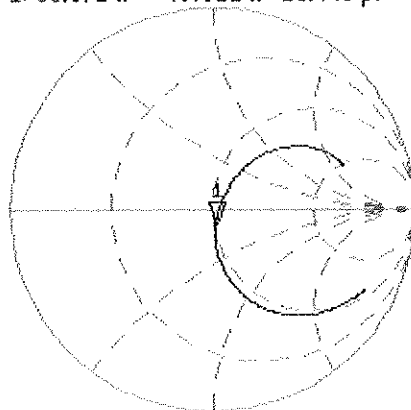
24 Aug 2009 11:32:41
 [CH1] S11 1 U FS 1: 50.971 Ω -7.4922 Ω 25.440 pF 835.000 000 MHz

*
 Del

CA

Avg
 16

↑

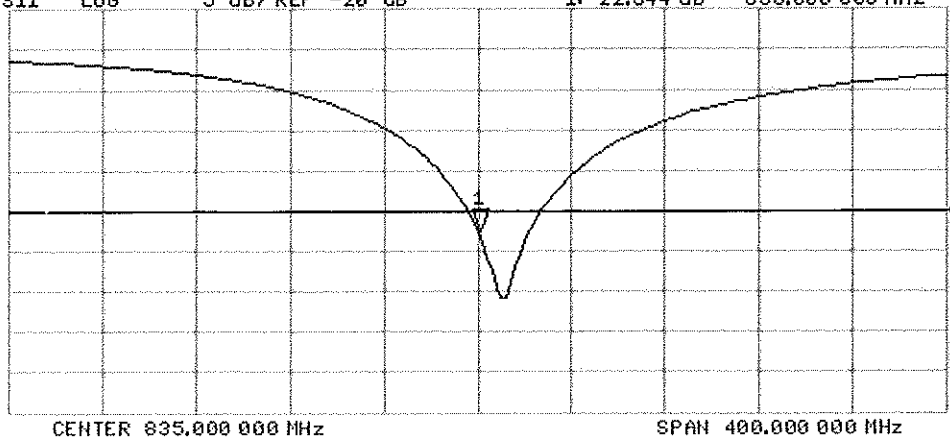


CH2 S11 LOG 5 dB/REF -20 dB 1:-22.544 dB 835.000 000 MHz

CA

Avg
 16

↑



DASY5 Validation Report for Body TSL

Date/Time: 17.08.2009 09:50:53

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d026

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900

Medium parameters used: $f = 835$ MHz; $\sigma = 0.99$ mho/m; $\epsilon_r = 53.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.97, 5.97, 5.97); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

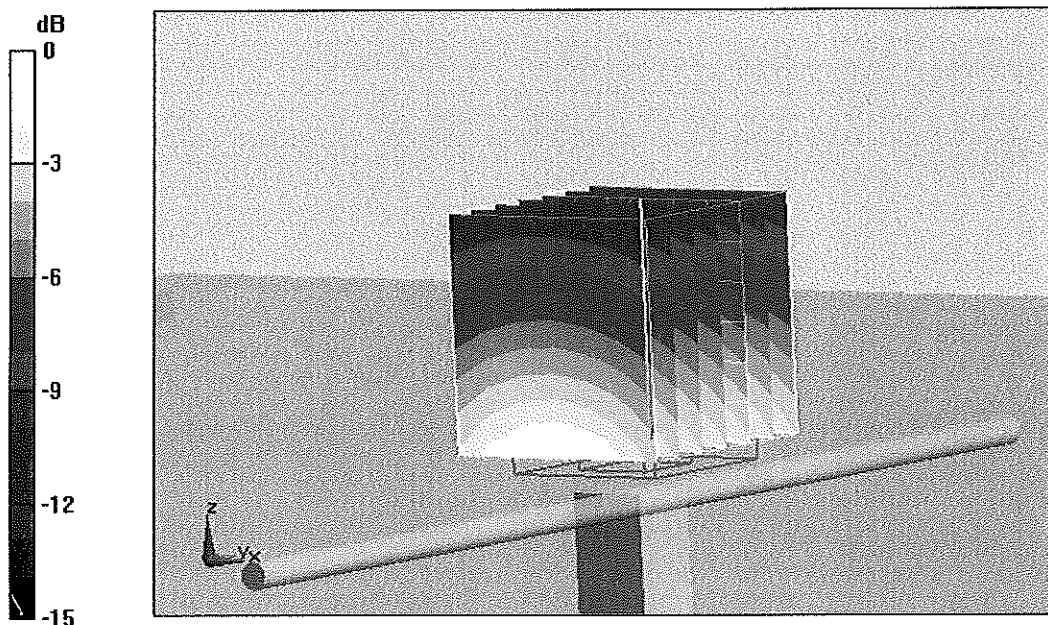
Pin = 250mW, d = 15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.8 V/m; Power Drift = 0.014 dB

Peak SAR (extrapolated) = 3.71 W/kg

SAR(1 g) = 2.5 mW/g; SAR(10 g) = 1.63 mW/g

Maximum value of SAR (measured) = 2.92 mW/g



0 dB = 2.92mW/g

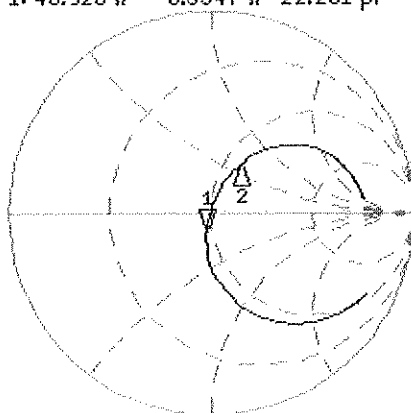
Impedance Measurement Plot for Body TSL

17 Aug 2009 08:48:23
 [CH1] S11 1 U FS 1: 46.928 Ω -8.5547 Ω 22.281 pF 835.000 000 MHz

*
 Del
 Cor

Avg
 16

↑



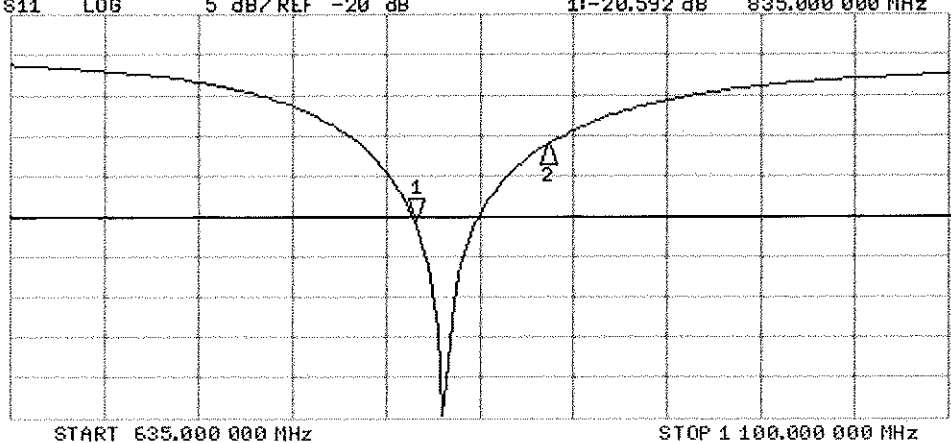
CH1 Markers
 2: 58.551 Ω
 30.164 Ω
 900.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -20.592 dB 835.000 000 MHz

Cor

Avg
 16

↑



CH2 Markers
 2: -11.110 dB
 900.000 MHz



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-5d080-Aug09**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d080**

Calibration procedure(s) **QA CAL-05.v7
Calibration procedure for dipole validation kits**

Calibration date: **August 18, 2009**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

Calibrated by: **Claudio Leubler** **Laboratory Technician** **Signature**

Approved by: **Katja Pokovic** **Technical Manager**

Issued: August 19, 2009

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Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.8 $\pm$ 6 %	1.45 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.0 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	condition	
SAR measured	250 mW input power	10.2 mW / g
SAR normalized	normalized to 1W	40.8 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	40.1 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.30 mW / g
SAR normalized	normalized to 1W	21.2 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	21.0 mW / g $\pm$ 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.9 ± 6 %	1.57 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 mW / g
SAR normalized	normalized to 1W	41.2 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	40.5 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.41 mW / g
SAR normalized	normalized to 1W	21.6 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	21.5 mW / g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0 Ω + 6.1 j Ω
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω + 5.7 j Ω
Return Loss	- 23.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.193 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 28, 2006

DASY5 Validation Report for Head TSL

Date/Time: 05.08.2009 14:25:51

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U11 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 40.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; dip = 10 mm, scan at 3.0 mm/Zoom Scan (dist=3.0 mm, probe 0deg)

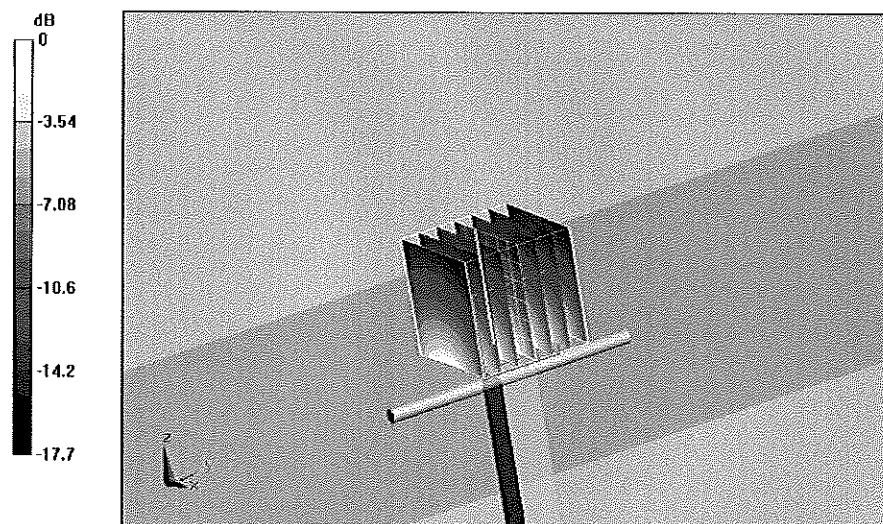
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.9 V/m; Power Drift = 0.040 dB

Peak SAR (extrapolated) = 18.7 W/kg

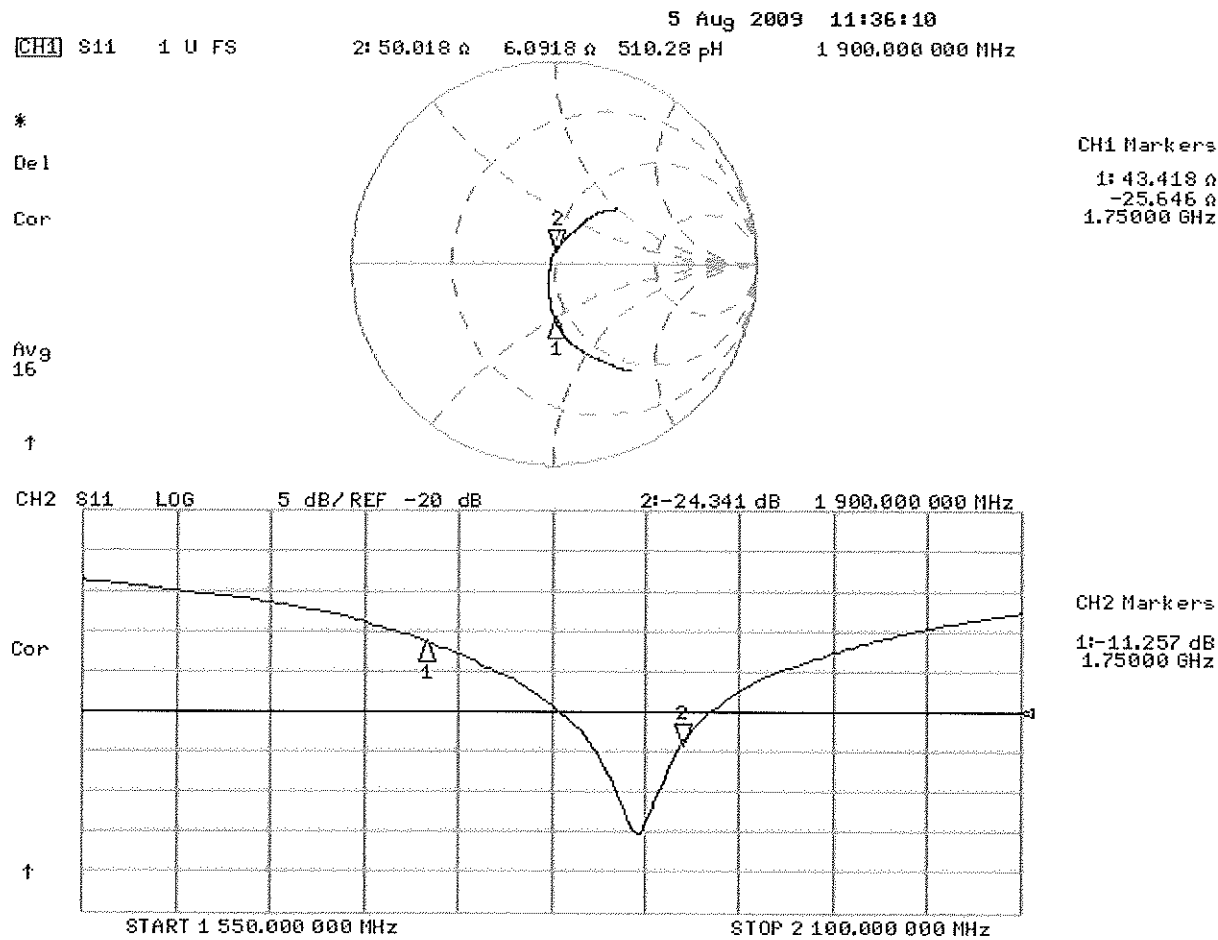
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.3 mW/g

Maximum value of SAR (measured) = 12.6 mW/g



0 dB = 12.6mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 18.08.2009 14:14:25

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.57$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; dip = 10 mm, scan at 3.0mm/Zoom Scan (dist=3.0mm, probe 0deg)

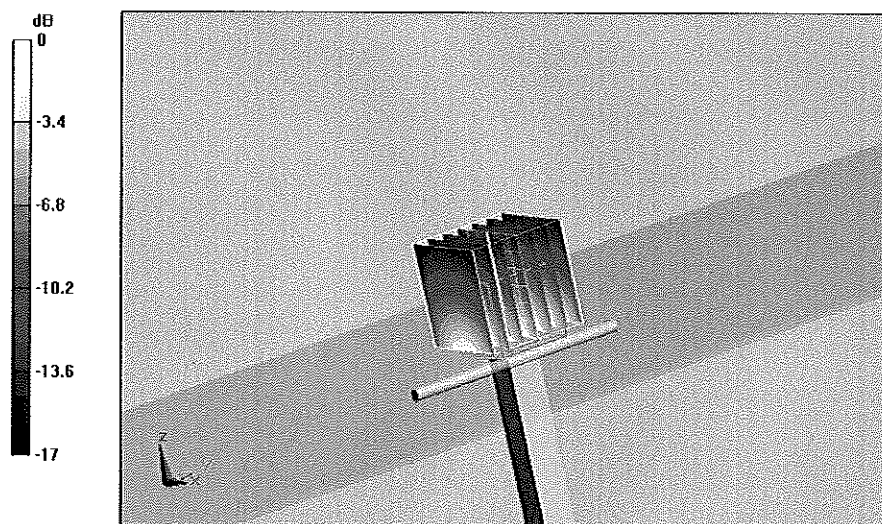
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.7 V/m; Power Drift = -0.00545 dB

Peak SAR (extrapolated) = 17.7 W/kg

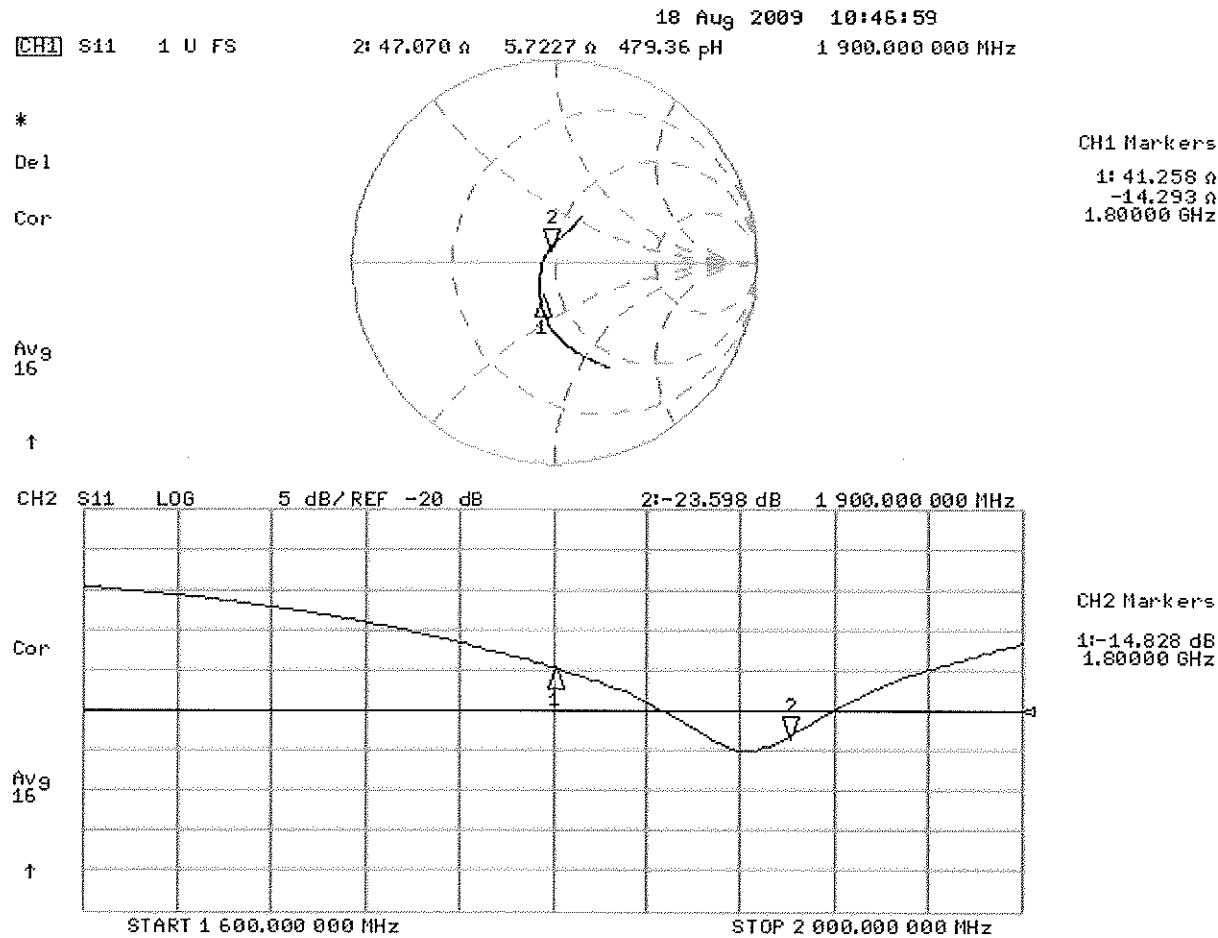
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.41 mW/g

Maximum value of SAR (measured) = 13.1 mW/g



0 dB = 13.1mW/g

Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d026_Aug09**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d026**

Calibration procedure(s) **QA CAL-05.v7
Calibration procedure for dipole validation kits**

Calibration date: **August 24, 2009**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (In house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	

Approved by:	Katja Pokovic	Technical Manager	
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Issued: August 25, 2009

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.2 $\pm$ 6 %	0.90 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.0 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 mW / g
SAR normalized	normalized to 1W	9.48 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	9.46 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 mW / g
SAR normalized	normalized to 1W	6.20 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	6.19 mW / g $\pm$ 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature during test	(22.5 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.50 mW / g
SAR normalized	normalized to 1W	10.0 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	9.78 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.63 mW / g
SAR normalized	normalized to 1W	6.52 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	6.42 mW / g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0 Ω - 7.5 j Ω
Return Loss	- 22.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.9 Ω - 8.6 j Ω
Return Loss	- 20.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.388 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 17, 2004

DASY5 Validation Report for Head TSL

Date/Time: 24.08.2009 13:11:23

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d026

Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL 900 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.9$ mho/m; $\epsilon_r = 41.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

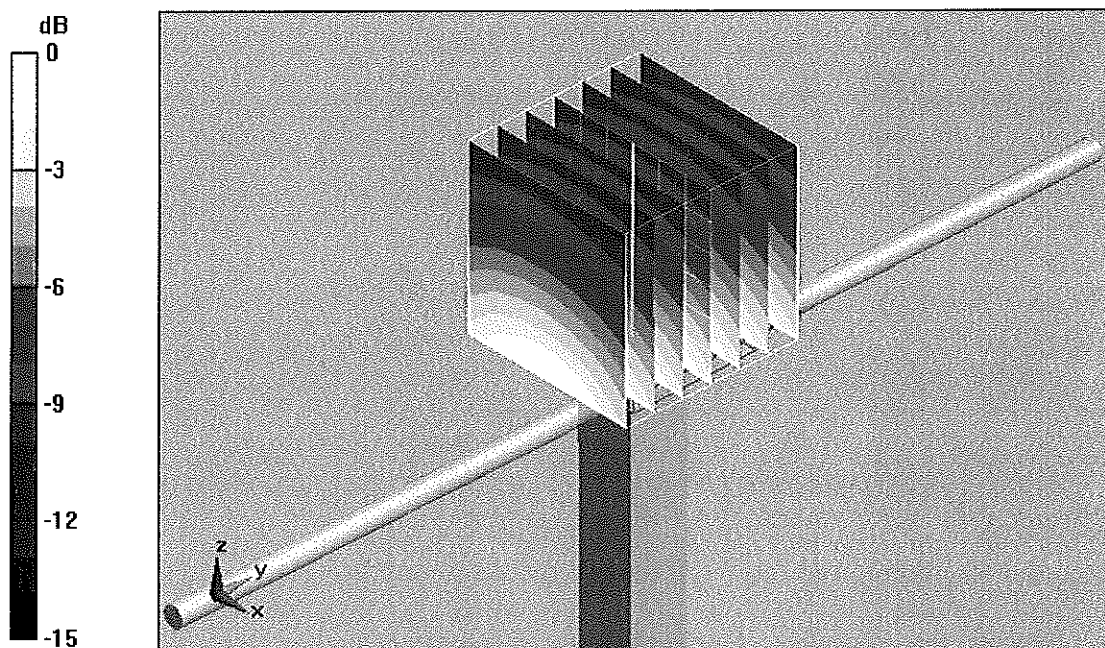
Pin=250mW; dip=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.1 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 3.55 W/kg

SAR(1 g) = 2.37 mW/g; SAR(10 g) = 1.55 mW/g

Maximum value of SAR (measured) = 2.77 mW/g



0 dB = 2.77mW/g

Impedance Measurement Plot for Head TSL

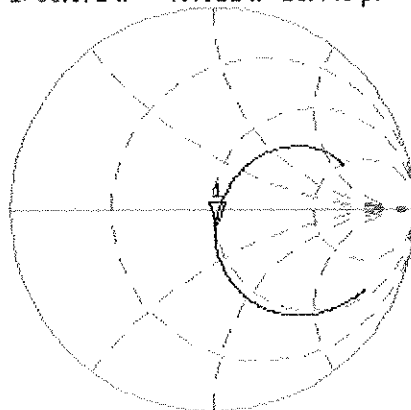
24 Aug 2009 11:32:41
 [CH1] S11 1 U FS 1: 50.971 Ω -7.4922 Ω 25.440 pF 835.000 000 MHz

*
 Del

CA

Avg
 16

↑

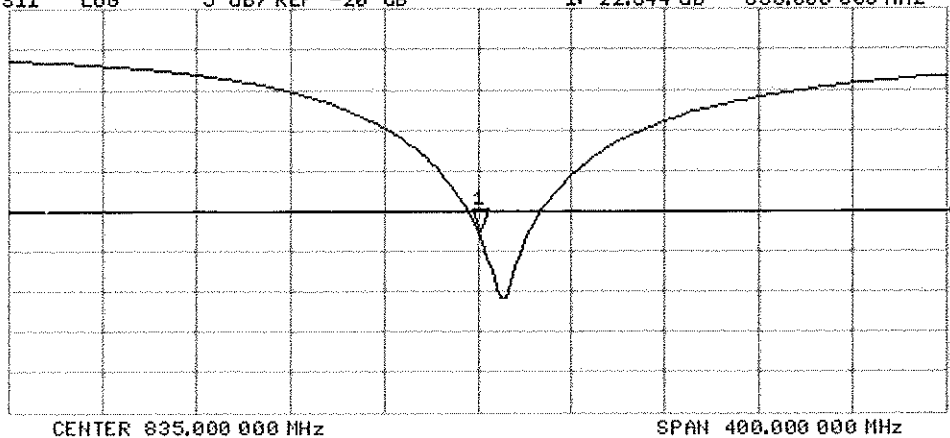


CH2 S11 LOG 5 dB/REF -20 dB 1:-22.544 dB 835.000 000 MHz

CA

Avg
 16

↑



DASY5 Validation Report for Body TSL

Date/Time: 17.08.2009 09:50:53

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d026

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900

Medium parameters used: $f = 835$ MHz; $\sigma = 0.99$ mho/m; $\epsilon_r = 53.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.97, 5.97, 5.97); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

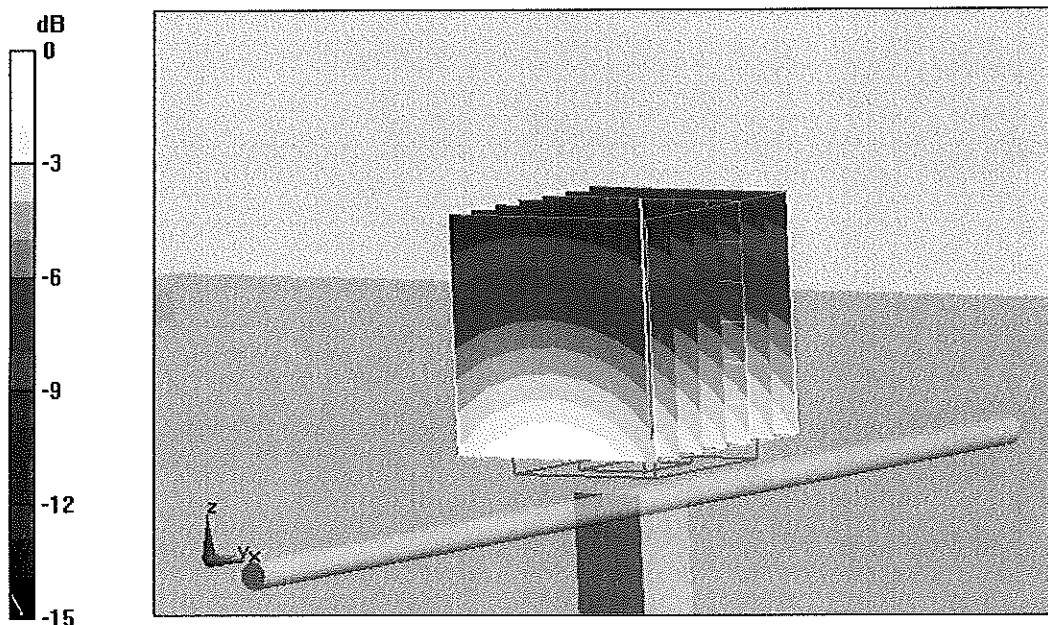
Pin = 250mW, d = 15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.8 V/m; Power Drift = 0.014 dB

Peak SAR (extrapolated) = 3.71 W/kg

SAR(1 g) = 2.5 mW/g; SAR(10 g) = 1.63 mW/g

Maximum value of SAR (measured) = 2.92 mW/g



0 dB = 2.92mW/g

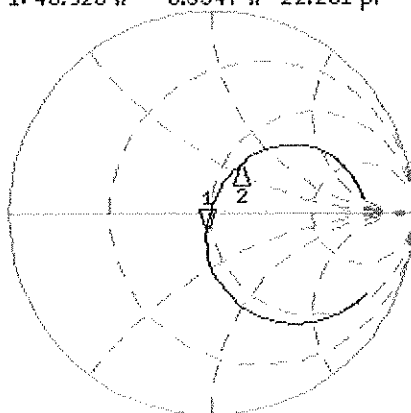
Impedance Measurement Plot for Body TSL

17 Aug 2009 08:48:23
 [CH1] S11 1 U FS 1: 46.928 Ω -8.5547 Ω 22.281 pF 835.000 000 MHz

*
 Del
 Cor

Avg
 16

↑



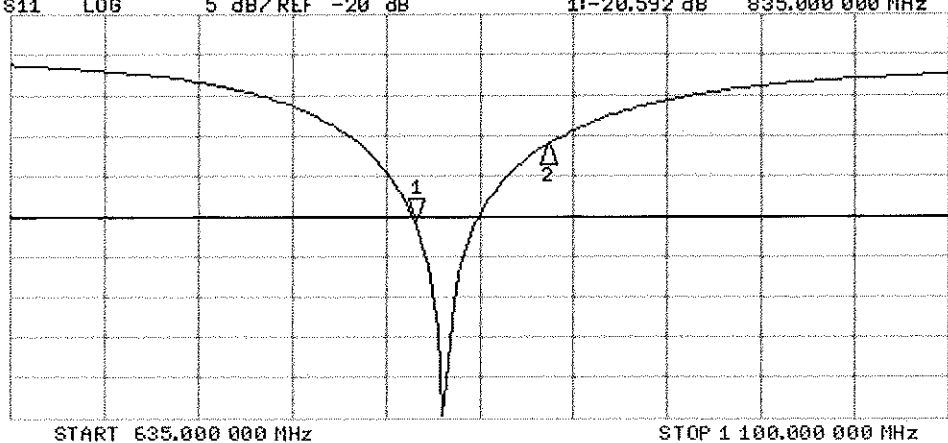
CH1 Markers
 2: 58.551 Ω
 30.164 Ω
 900.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -20.592 dB 835.000 000 MHz

Cor

Avg
 16

↑



CH2 Markers
 2: -11.110 dB
 900.000 MHz



Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-5d080-Aug09**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d080**

Calibration procedure(s) **QA CAL-05.v7
Calibration procedure for dipole validation kits**

Calibration date: **August 18, 2009**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

Calibrated by: **Claudio Leubler** **Laboratory Technician** **Signature**

Approved by: **Katja Pokovic** **Technical Manager**

Issued: August 19, 2009

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.8 $\pm$ 6 %	1.45 mho/m $\pm$ 6 %
Head TSL temperature during test	(22.0 $\pm$ 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	condition	
SAR measured	250 mW input power	10.2 mW / g
SAR normalized	normalized to 1W	40.8 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	40.1 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.30 mW / g
SAR normalized	normalized to 1W	21.2 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	21.0 mW / g $\pm$ 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.9 ± 6 %	1.57 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 mW / g
SAR normalized	normalized to 1W	41.2 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	40.5 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.41 mW / g
SAR normalized	normalized to 1W	21.6 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	21.5 mW / g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0 Ω + 6.1 j Ω
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω + 5.7 j Ω
Return Loss	- 23.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.193 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 28, 2006

DASY5 Validation Report for Head TSL

Date/Time: 05.08.2009 14:25:51

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U11 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.45$ mho/m; $\epsilon_r = 40.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; dip = 10 mm, scan at 3.0 mm/Zoom Scan (dist=3.0 mm, probe 0deg)

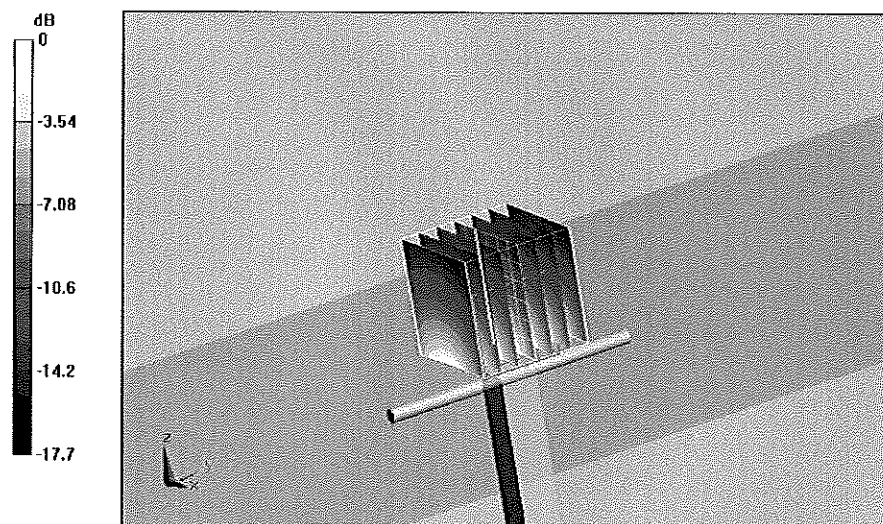
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.9 V/m; Power Drift = 0.040 dB

Peak SAR (extrapolated) = 18.7 W/kg

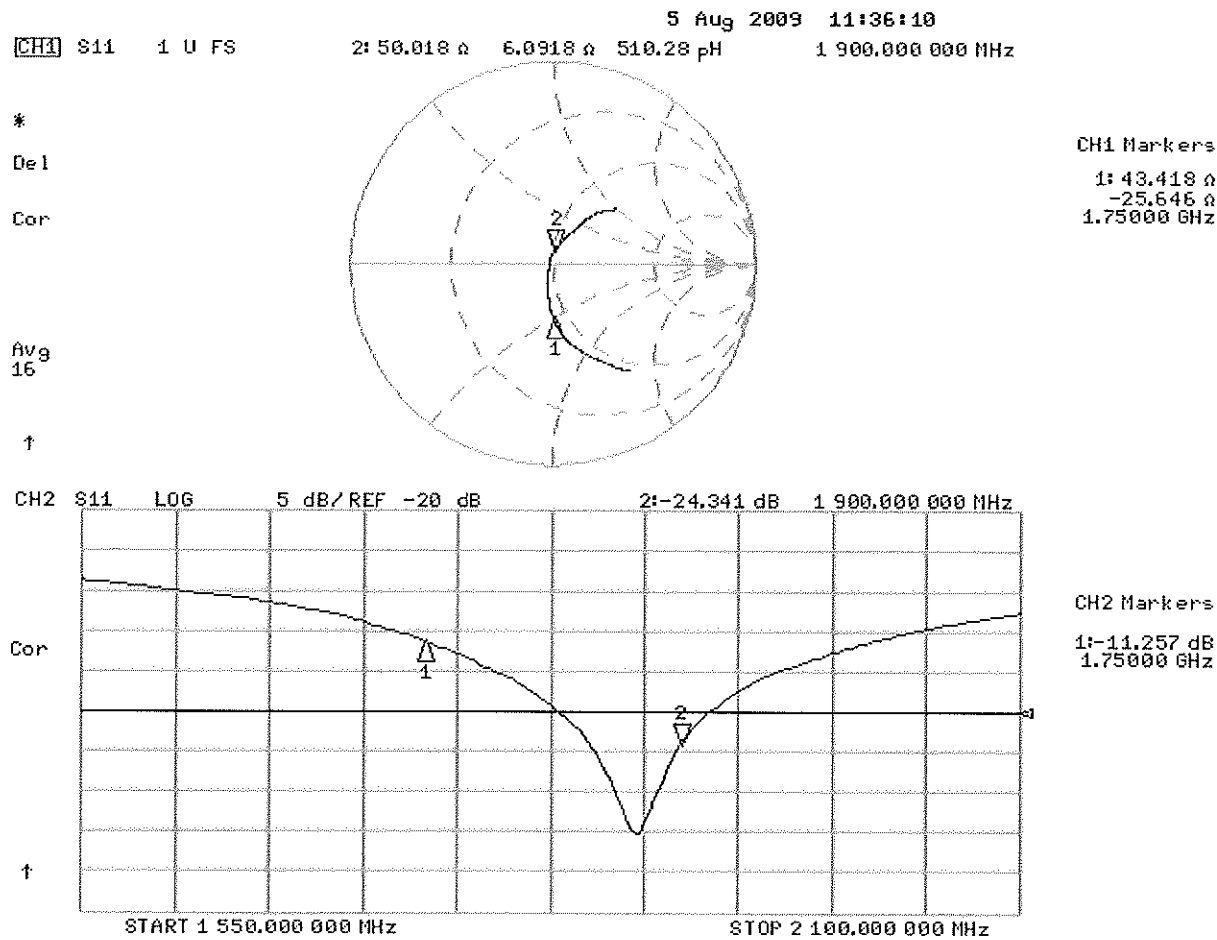
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.3 mW/g

Maximum value of SAR (measured) = 12.6 mW/g



0 dB = 12.6mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 18.08.2009 14:14:25

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.57$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

Pin = 250 mW; dip = 10 mm, scan at 3.0mm/Zoom Scan (dist=3.0mm, probe 0deg)

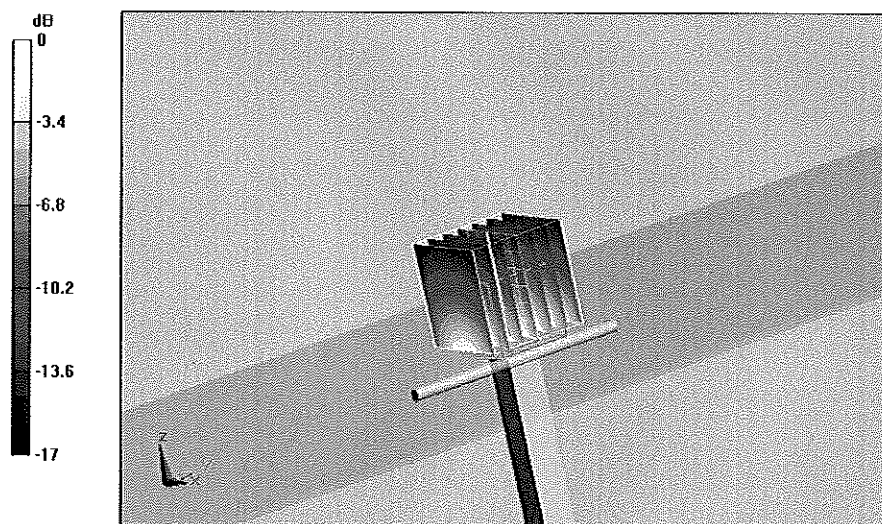
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.7 V/m; Power Drift = -0.00545 dB

Peak SAR (extrapolated) = 17.7 W/kg

SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.41 mW/g

Maximum value of SAR (measured) = 13.1 mW/g



0 dB = 13.1mW/g

Impedance Measurement Plot for Body TSL

